THE MINERALS OF NOVA SCOTIA.

GILPIN.

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SHELBURNE
HANTS
KING'S
HALIFAX
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THE

MINERALS

OF

NOVA SCOTIA,

BY

EDWIN GILPIN, Jr., A.M., Ll.D., Fellow Royal Society of Canada,
Etc., Etc.,

CHIEF INSPECTOR OF MINES, AND

DEPUTY COMMISSIONER OF PUBLIC WORKS AND MINES.

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HALIFAX, NOVA SCOTIA, May 1st, 1901.

The Honorable George H. Murray,
Provincial Secretary:

SIR,—

I beg leave to submit the following report on the mines and mineral lands of Nova Scotia. I have endeavored to give in a brief form information intended to convey in a general manner the extent and value of the mineral resources of the Province.

I have the honor to remain,

Your obedient servant,

EDWIN GILPIN, JR.,

Deputy Commissioner and Chief Inspector of Mines.

INTRODUCTION.

In the following pages I have tried to describe briefly the mineral resources of the Province.

For its extent Nova Scotia compares more than favorably with any of the Provinces of the Dominion. Its wealth is not confined to minerals. Large tracts supply in abundance the vegetable products of the northern temperate zone. Its shores are surrounded by extensive and valuable fisheries. Its forests furnish an unlimited lumber supply, and abundant water powers are being brought into increased use.

The peculiarly diversified nature of the Nova Scotia minerals may be judged of by the fact that it has in close relationship the three most valuable, iron, coal, and gold. The initiation of extensive iron and steel works is directing attention to our large deposits of ore, and of fuel yielding coke claimed to be the best in the world. Among other minerals more or less worked may be mentioned lead, zinc, silver, copper, manganese, gypsum, barytes, etc.

GEOLOGY OF NOVA SCOTIA.

I give the following outline of the geology of Nova Scotia, as serving to indicate in a rough manner the extent and ages of the strata, which at one point present to the farmer soils well adapted to recompense his labor, and at another hold the treasures which excite the cupidity of the miner.

I am indebted to Mr. Ami, of the Canadian Geological Survey, for information on this subject, but it may be remarked that on several points definite conclusions cannot yet be drawn.

The Laurentian system is well developed in Cape Breton, occupying the more elevated portions of the island. There are apparently two series—the lower series carrying an extensive calcareous development in addition to the granites, syenites, felsites, slates, etc., common to both. These measures carry gold, silver, lead, zinc, graphite and iron ores, and doubtless will yield the other minerals characterizing the system in Quebec and Ontario.

The Huronian system is not yet recorded as occurring in Nova Scotia.

The upper and lower divisions of the Cambrian are represented here. To the former the gold-bearing series, consisting of an upper slate formation and a lower quartzite formation, has been referred. The foldings of these strata have been broken through by masses of granite at a date slightly preceding the Carboniferous era.

Below McAdams' Brook, Escasonie River, near McPhee's Point, and along the Mira River in Cape Breton, are beds referred to the upper Cambrian. These strata frequently carry ores of iron.

It is interesting to note that the iron-ore deposits of Bell Island, in Newfoundland, are referred to the Ordovician system, and that large areas in the eastern counties are provisionally referred to this system on stratigraphical evidence. This determination, however, requires paleontological corroboration.

The upper division of Sir R. Murchison's Silurian is extensively developed in Nova Scotia. It is typically developed at Arisaig and extends into Pictou County. It also occurs from Nictaux to Wolfville, and at several points along the northern side of the Cobequid Mountains. This formation is noted at several points for large deposits of iron ore.

The Devonian is represented at Nictaux and Arisaig, at both points containing deposits of iron ore. Large areas in Cape Breton, Richmond and Guysboro counties are referred to this age, and contain iron and copper ores.

The Carboniferous system is typically developed in Nova Scotia, in the northern and eastern counties. The productive horizon is met in the counties of Cape Breton, Richmond, Inverness, Pictou and Cumberland. This is underlaid by millstone grit, carboniferous limestones, and lower or basal conglomerates. Along the shore of the Straits of Northumberland and in the interior of Cumberland county are still higher divisions of the Carboniferous apparently passing into the Permian, and they have been termed Permocarboniferous.

The Triassic system is represented on the Bay of Fundy and the Basin of Minas by beds of bright red sandstone, associated with amygdaloidal traps and ash beds. Of the succeeding systems, the Cretaceous system is reported present in a few small areas resting on the Triassic eruptions, and the Quarternary system records the glacial action which this province has been subjected to in common with the rest of the Acadian region.

COAL, SHALES, PETROLEUM, ETC.

THE COAL FIELDS OF NOVA SCOTIA.

The coal mining industry began many years ago in Nova Scotia, but it has only assumed important proportions during the past few years. Mr. Richard Brown, in his books on Cape Breton coal, has given in detail the difficulties of the trade in its infancy.

The coal found in Nova Scotia is bituminous, and is in nearly all cases, coking. It is a true coal from the middle or productive measures of the Carboniferous division, and resembles in appearance and quality the coals of Durham and Northumberland in England.

It may be mentioned here that all the Nova Scotia coal fields are on tide water, an advantage enjoyed by no other district on the Atlantic seaboard of America.

Cape Breton.

The island of Cape Breton, at the eastern end of the province, holds several important coal deposits. The Sydney coal field, in Cape Breton County, extends for 35 miles along the shore, and extends inland several miles. Its available area may be estimated at over 300 square miles, although recent discoveries of coal may add materially to this estimate. The seams are presented in regular beds, dipping at easy angles to the eastward, under the Atlantic. The district is bisected by Sydney Harbor, one of the finest on the Atlantic coast, and has Louisburg Harbor at one end and the Big Bras d'Or at the other end.

The following section from the Geological Survey reports shows the seams known in 1874.

Cow Bay.	Glace Bay.	Lingan.		Sydney Mines.	Boulardarie.
Seam.	Seam.	Seam.	Strata and Coal. ft. in.	Seam.	Seam.
.....	....	Seam A.....	3.0 306.0	....	Point Aconi.
.....	....	Carr.....	6.5 190.0	Lloyd's Cove.....	Bonar.
....	Hub.....	Barrasois.....	12.1 379.3	Seam B.....	Stubbart.
Block House	Harbor	{ Victoria..... { David Hd	8.0 235.0	Sydney Main	Seam C.
Seam D.....	Boutillier	Seam D.....	3.0 78.0	Bryant.....	Mill Pond.
Seam E	Back Pit	North Head	4.0 75.0	Edward	Black Rock.
McAulay	Phelan.....	Lingan Main.....	8.0 95.0	Seam F.....	Seam F.
South Head..... Spencer	{ Ross ..... { Emery.	Seam G.....	4.6 340.0	Collins.....	Seam G.
Long Beach	{ Lorway ..... { Gardener.....	Seam H.....	4.9	....	....

Tracey, Mullins, and other Seams.

Explorations have since shown that lower down in the Carboniferous there are workable beds of good quality underlying these given in the section.

At present there are five companies working in the coal field. The largest, the Dominion Coal Company, has control of the Glace Bay section, where it works the Phalen and Emery and International seams on a large scale. The following collieries are in operation, the Caledonia, International, Reserve, and Dominion Nos. 1, 2, 3, 4. The last three are in process of development. These collieries are up to date in every respect, and last year produced 1,930,425 tons of coal, an amount greatly to be increased in 1901, as the newer mines come into full operation. The pits are filled with all modern improvements of endless haulage, compressed air for pumps and mechanical coal cutters, fans, picking tables, etc.

A railway connects the operations of this company with the Intercolonial (Government) railway, with two piers in Sydney harbor, and one at Louisburg, and with the plant of the Dominion Iron and Steel Company. There are about 40 miles of road, not including sidings, laid with 80 lb. rails, and fully equipped.

The piers can take the largest steamers afloat and load them through shoots at any tide, and are provided with appliances for loading coal without breakage, etc. The Louisburg pier has also a system of conveying belts from large pockets capable of loading in addition to the regular pier work over 600 tons per hour. These three piers can readily load 18,000 tons per day.

In the Cow Bay district the Gowrie and Blockhouse Collieries are developing an extensive submarine area in the Gowrie seam, long known and worked on the land. Their works are on the shore, and the coal passes direct to the vessels without the intervention of railway haulage.

On the north side of Sydney harbor the Nova Scotia Steel Company are working the Sydney main seam. The workings on this seam, begun over 100 years ago, are at this point entirely submarine. The coal enjoys a a reputation for house purposes, and as it makes an excellent coke will be largely used in the steel works the company contemplate building at this point. The output last year was 249,910 tons.

The Sydney Coal Company on an adjoining area are working a lower seam, but have not yet effected a development permitting of a large annual output.

At the extreme northern end of the field, at New Campbelton, the Messrs. Burchell Bros. are working seams, considered the extension of those of the Nova Scotia Steel and Sydney Coal companies. They effect an annual output of 12,426 tons, and control a large and valuable field.

The total production of this coal field last year was 2,199,983 tons. This district ships largely to Newfoundland and Prince Edward Island, sends about 1,000,000 tons up the St. Lawrence, and after supplying about 600,000 tons to the United States, distributes the remainder at various points in Nova Scotia.

The completion of the great plant of the Dominion Iron and Steel Company will this year call for a much increased output, to which possibly in another year will be added the demands of the furnaces the Nova Scotia Steel Company contemplate erecting. So far as can be judged at present the collieries will not be able to meet the demand. In addition to the large territories controlled by the companies named there are valuable tracts of coal lands yet untouched, and probable extensions in addition.

Quality of the Coals.

The following analyses will serve to show the character of the seams in this district:

	Emery.	Gowrie.	Phalen.	International.	Sydney.
Moisture	.64	.50	.52	.80	1.536
Volatile combustible matter	31.10	28.13	34.21	27.55	36.362
Fixed carbon	63.10	66.01	59.73	65.90	57.008
Sulphur	1.51	1.75	.81*	1.45	1.894
Ash	3.65	5.36	3.92*	4.30	5.084

*Note.—Ash and sulphur average of nearly two hundred assays.

In volume X. of the Transactions of the Nova Scotia Institute of Science, I have given summaries of sets of tests of Phalen and Harbor seam coals in closed coke ovens for coke and by-products. The following results were obtained from the Phalen seam. It yielded per long ton 11,012 cubic feet of gas, having an average calorific power of 571.85 B. T. U., and an average illuminating power of 9.9 candles, and with a Welsbach burner, 54.34 candles. The gas contained:—

Carbon dioxide	2.7
Illuminants	2.9
Oxygen	.13
Carbon Monoxide	5.8
Marsh gas	32.3
Hydrogen	51.1
Nitrogen	5.07

The total yield of coke was 74.68 per cent. The ammonium sulphate per ton amounted to 32.91 lbs., the tar amounted to 12.89 gals., and the benzole amounted to .103 gals.

I pointed out a number of years ago that this coal field contained beds capable of yielding a coke equal to that from Connelsville, in Pennsylvania, admittedly the best in America, and dwelt upon the importance of this factor in iron making. The coke made at the works of the Dominion Steel Company from unwashed Glace Bay coal has answered every expectation, and by washing the amount of sulphur and ash will be decreased to a point seldom attained in commercial coke.

The coals of this district are admirably adapted for gas, coke, domestic

use, and for marine and land boilers. They ignite readily, burn with a long flame, and when properly burned do not make an excessive smoke.

In the district extending from Cow Bay to the Mira and Salmon Rivers, a number of small coal seams have been noticed, and explorations may prove the presence of larger deposits.

At River Inhabitants, Richmond County, isolated crops of workable seams occur over a large tract of country, but as yet have received little attention. In Inverness county, on the western side of Cape Breton, there are several coal fields. The most southerly is presented at Port Hood. Here the crops are known of two seams, each about six feet in thickness, and of another smaller one. These seams crop on the shore, and as the coal measures extend inland and along the shore for several miles, explorations will probably increase the area. As the Port Hood islands lie a short distance from the shore on the dip of the beds it is anticipated that a very large submarine area will be available. On the lower of the larger seams a slope is being sunk, and arrangements made for a large output, to be shipped within a few yards of the bankhead.

At Mabou there are similar outcrops, comprising a four feet bed, a thirteen feet bed, a seven feet bed, a five feet bed, and others reported. Operations are now under way to open submarine workings at this point.

At Broad Cove, explorations have shown a considerable land and sea area containing, it is said, the following section :—

First Seam	2	feet.
Second "	2	"
Third "	3	"
Fourth "	4	"
Fifth "	12	"
Sixth "	7	"
Seventh "	4	"
Eighth "	3	"

The control of this district has passed into the hands of the Inverness and Richmond Collieries and Railway Company, and they have commenced a modern colliery, capable of working a large land area, and of indefinite extension on the seams under the sea.

Still further north comes the Chimney Corner coal field, which has a land area 15 miles long and 3 miles wide, with an equally large submarine area. The following is given as the section of the seams at the northern end of the district where a little mining was carried on a number of years ago. There is nothing known of the seams of the lower group. The upper contains a three feet bed, a three feet six inches and a five feet bed. The extension of these seams has not been traced any distance from the shore, but about five miles away the crops of two six feet seams are known.

At Glendale, on the upper waters of the River Inhabitants, there is a

small coal basin holding two three feet seams of coal. No work has been done here to test the value of the deposits, which are presumably an outlier of the Richmond coal field already referred to.

Passing to the mainland there are outcrops of small seams at Pomquet, in Antigonish county. At Hollowell Grant, in the same county, are beds of shale so charged with bituminous matter as to possess some of the properties of coal, but they are probably more valuable as a source of oil, etc. Small seams of coal are found at Nine Mile River, Hants county, and along the southern flanks of the Cobequid Mountains in the counties of Colchester and Cumberland.

PICTOU.

In Pictou county, coal has long been worked in a field the dimensions of which are fairly well ascertained. The district forms a main east and west synclinal, covering about 35 square miles. There are about thirteen seams of coal from 3 feet 6 inches to 30 feet in thickness. The greater part of the district is controlled by two companies, the Intercolonial and the Acadia. There are still unworked a number of valuable areas belonging to the Nova Scotia Steel Company, Messrs Gray, Barton, Richey and others.

The Intercolonial company works the main and underlying seams at Westville, producing last year 244,000 tons of coal. It is connected with the Canadian Government (Intercolonial) Railway, which intersects the district, and with a private shipping pier at Granton, on the Middle River, distant about five miles. The Acadia company works the same seam at Westville, and has two collieries on the Albion seams at Stellarton, and another at Thorburn, in the eastern end of the district working the six feet seam. These collieries had an output last year of 294,884 tons, and are all connected with the Government railway and with a shipping pier in Pictou harbor, distant eight miles from New Glasgow, the centre of the district.

The coals of the Pictou district are less bituminous than those of Cape Breton. Some are possessed of good coking properties, while others are not suited for this purpose. They are however good steam coals, and well adapted for use in iron works, etc., and are largely used for domestic fuels.

The following analyses, though not recent, will serve to convey a general idea of their composition :—

	Acadia.	Intercolonial.	Deep.	Montreal and Pictou.
Moisture	2.10	1.52	.75	1.76
Volatile combustible matter	29.20	29.46	20.34	22.43
Fixed carbon	61.15	60.19	68.50	67.73
Ash	7.55	9.10	10.41	7.12
Sulphur	1.48	1.62	.94	.96
Theo. evaporative power	8.50	8.24	9.39	....

Outcrops of small coal seams are known in the district between New Glasgow and Pictou, but geologists consider they are not indicative of large deposits.

The coal of the district is used locally for the works of the Nova Scotia Steel Company, foundries, and other manufacturing works, on the railway, at Halifax for bunkering steamers, as well as in Prince Edward Island and Quebec.

CUMBERLAND COAL FIELD.

The northern edge of this coal field begins at the Joggins, on Chignecto Bay, and runs easterly in an almost straight line for about 19 miles. From this point the continuation of the seams has not yet been traced to the southern edge at Springhill. At Springhill the reverse side of the field is presented in an outcrop several miles long, and folded in irregular curves. The country lying between Springhill and Apple River on Chignecto Bay has not yet been explored, but it may be anticipated that the continuation of the southern outcrop of the field will be found along this line. The proved extent of the coal field has been materially increased during the past two years in the Springhill district, but as yet it can only be said that it probably extends over 350 square miles.

The principal seam worked on the northern side is known as the Joggins main seam, of the Canada Coals and Railway Company. This seam is about six feet thick and yields annually from 60,000 to 80,000 tons. Coal is shipped by water at the mine to various points on the Bay of Fundy, and by a branch railway ten miles long to the main line of the Intercolonial Railway. A number of smaller seams are worked along the northern side of the field on a limited scale to supply local winter markets. The coals of this section are best known as steam and domestic fuels.

At Springhill is the large colliery of the Cumberland Railway and Coal Company. Here three seams from 6 to 14 feet in thickness are extensively worked, the output last year amounting to 428,904 tons. Other underlying seams of workable size are known here and await development.

The Springhill coals are shipped over the company's railway 4 miles to the Government Railway, or about 30 miles to the company's piers at Parrsboro, on the Bay of Fundy. From this point shipments are maintained all winter by barges to Portland, St. John, etc. The coal is found to be specially adapted for steam purposes, and is largely used by the Government, Grand Trunk and Canadian Pacific roads. In quality it is less bituminous than that from Cape Breton, and has the following general analysis :—

Vol. Comb. Matter	28.55
Fixed Carbon	62.78
Moisture	3.66
Ash	4.32
Sulphur	1.26
Theo. Evap. Power	8.69

To the east of Springhill, there are seams of coal apparently belonging to a horizon lower than that occupied by the seams just referred to. So far as any work has been done the seams are smaller, not exceeding 4 feet in thickness They have been found to a limited extent at Salt Springs and at Oxford, and crops of similar beds are reported in the Thompson district. Further work may place this section in the list of those available for economic mining. It may be said that in this county the opportunities for the discovery of coal are greater than at the longer worked districts of Pictou and Cape Breton Counties, and that the facilities for marketing the coals are better, as it lies nearer New Brunswick and the United States.

Cannel Coal, Shales, Etc.

Beds of cannel coal are met at several places in the Sydney coal field. The deposits have, I believe, not been examined in any detail, and are reported to be limited in extent.

On the North side of East Bay the manufacture of oil, etc., has been started on beds of bituminous shale in lower carboniferous conglomerate rocks. There are a number of beds ranging for several miles, and the supply is said to be unlimited. The following results are said to have been attained on working tests :

Kerosene Oil	1.25
White Spindle Oil	1.25
Heavy Lubricating Oil	2.50
Pitch	1.25
Water	5.75
Coke	87.50
Loss, gas, etc	.50

The products, which are now being introduced on the market, are said to be well received. Bituminous shales are not uncommon in the province in the lower divisions of the carboniferous. They occur at Port Hastings, Inverness county, and at Hollowell Grant, Antigonish county. At the latter place tests were made a number of years ago on several beds from 5 to 15 feet thick, with satisfactory results.

In Pictou county, on the property of the Acadia Company, among the lower beds of the coal field, there is an interesting cannel coal, known as Stellarite. It is associated with a layer of oil shale and of bituminous coal. The cannel and shale were worked to some extent a number of years ago, and yielded 60 gals. of crude and 35 of refined oil. Its ultimate analysis gave :—

Carbon	80.96
Hydrogen	10.15
Nitrogen, Sulphur, Oxygen	.68
Ash	8.21

It is said to be present on the northern dip of the coal field, in which case it would underlie a considerable territory. Other shales, said to be rich in oil, are reported from the eastern part of the district, and many portions of the 1,200 feet of shale overlying the main seam are stated to yield considerable amounts of oil. Shales, apparently highly bituminous, occur at Cheverie, Horton and Kennetcook. Should the attempts now being made to work the East Bay shales prove remunerative, there should be ample room for extensive works of a similar character in the province. The oil shale industry of Scotland has been established for many years, and has flourished in spite of the competition of the United States.

Graphite.—In the presilurian strata graphitic slates are frequently observed. They are often met as a distinctive rock in the upper division of the gold measure strata. In Cape Breton at Glendale, West Bay, Grand Narrows, East Bay, Hunter's Mountain, etc., deposits have been found, yielding good commercial results. While the abundant deposits met in the United States may prevent the importation of the raw material, it might be found that its manufacture could be carried on here.

Other localities are Parrsboro, Musquodoboit, Salmon River, Hammond Plains, etc.

Oil. Indications of petroleum have been observed around Lake Ainslie, Inverness County, and for a number of years attempts have been made to find its source. A number of bore-holes have been put down without positive results. It may be found that the district in the headwaters of the Mabou, Denys, and Inhabitants Rivers presents a more favorable field for prospecting. Oil is also found at Cheverie, Hants County, but I am not aware of any attempt to prove its presence from an economic point of view.

NOVA SCOTIA GOLD FIELDS.

The gold fields of Nova Scotia became known about the year 1860, and were soon proven to occupy the Atlantic coast of the province.

Investigation showed that this district was occupied by two divisions of rock, granite, and slates and quartzites. Geologists referred the latter to the lower Cambrian age, a series of rocks known to be auriferous in other parts of the world.

In Nova Scotia they are divided into the lower or quartzite group, and the upper or ferruginous and graphitic slate group. The lower group, to which a thickness of over 11,000 feet is assigned by Mr. Faribault, consists principally of quartzite, interstratified with numerous beds of slate varying in colour and texture, and with a few beds of compact conglomeritic rock. The upper group, which is over 4,000 feet thick, is almost wholly composed of bluish black soft slates.

By the labors of Mr. Faribault, the pioneer of the Geological Survey in the mapping of the gold fields, much detailed information has been collected, and I am indebted to him for his clear presentation of the most interesting facts relating to the stratigraphy of the rocks under consideration.

These measures, originally horizontal, have been moved by a powerful and uniform pressure from the south, exerted in a line roughly parallel to that of the coast, which has folded them into a series of sharp parallel undulations or folds. By denudation these folds have been so worn down that in a generally level country they have been extensively exposed in horizontal sections, showing within a few hundred yards the reverse dips, to the north and to the south. The rocks generally dip at an angle of 75° to 90°, seldom lower than 45°, and overturns are frequently noted.

Estimates allow that about one-half of the auriferous district is occupied by granite, making the extent of the gold fields about 3,000 square miles. The granite is presented in masses and dykes of varying shape and size, and appears, broadly speaking, to have melted through the slates and quartzites. The granite is not generally considered to be auriferous, although gold has been found in quartz veins in it at points far distant from the slates and quartzites.

The upper or slate group is not recognized by miners as auriferous, although quartz veins occur in it, and sometimes show gold. It may be found, however, on further examination to hold extensive deposits of low grade ores.

Attention has therefore been confined principally to the lower or quartzite group. From Mr. Faribault's observations it appears that the gold belts occur at a distance below the base of the upper or slate group, varying from 2,800 to 8,000 feet, giving a thickness of about 5,000 feet of auriferous strata. Veins occur at other points in the lower group of rocks, but have not yet been found to be pronouncedly rich in gold.

It will therefore be seen that wherever this section of the lower group has been folded, denuded and exposed, there the best fields are opened for exploration and work. Eleven of these auriferous anticlinals have been defined between Sheet Harbor and Caledonia. There are many others succeeding these, starting from the shore and passing obliquely away from it. The district to the eastward of Halifax has been carefully mapped by the Geological Survey, and the courses of these auriferous anticlinals laid down approximately between the points where they are known exactly by mining operations. These maps are on a scale of one mile to the inch, and give minute topographical details, so that the localities where prospecting can be most advantageously carried on are readily observed. In order that information may be available as to the district lying west of Halifax, Professor Bailey has examined, in less detail, the counties of Lunenburg, Queens, Shelburne and Yarmouth. In these districts there are larger areas of granite, but the same general structure is preserved. The maps and reports relating to the gold fields are invaluable to gold miners, and can be obtained by payment of nominal prices from the office of the Canadian Geological Survey at Ottawa.

The auriferous quartz veins of Nova Scotia occur in these anticlinals, intercalated between the layers of quartzite and slate as beds running parallel with the strata. They are seen to turn on their course where the anticlinal axis has become depressed, and underground operations have shown them rising up on one side and dipping down on the reverse side without a break in their continuity, or giving any surface indication of their existence. They extend in many cases for thousands of feet, and have been followed to depths of seven hundred feet in their vertical extension. In size they vary from an inch up to twelve or fifteen feet; many of the most productive are from six to fifteen inches in thickness. They present in spite of their bedded position many of the characteristics of typical veins. Their essential ingredient is quartz, varying in texture and color; in many of the more productive veins presenting a smooth surface and bluish shade. There is always present a varying percentage of iron, copper, lead and zinc sulphides and traces of other minerals. Cross or fissure veins also occur at Rawdon, Caribou, Blockhouse, Oldham, Brookfield, etc., and are frequently productive.

The gold is present characteristically in the free state as irregular masses, varying from microscopic particles to irregular patches, often several ounces

in weight. It is also present in films covered by the metallic accompaniments, and as invisible particles. There are also quartz veins almost free from sulphides, etc., yielding gold in workable amounts, although it is not visible. But little attention has yet been paid to this class of veins, unattackable by the ordinary quartz mills, although adapted for chemical treatment by the more modern systems. In the veins the gold is sometimes distributed with comparative uniformity over considerable areas; usually however, it is more or less concentrated within certain defined limits, leaving spaces on each side comparatively barren. These enriched zones are known as pay streaks, are repeated in some veins, and follow certain laws not yet clearly understood. They have hitherto been the principal source of the gold production.

Gold is also found sparingly in the quartzite beds and more abundantly in the slates. The latter when in contact with the quartz frequently show it in thin platings, and the small veinlets of quartz seaming the slates often carry gold. When one or more quartz veins occur in connection with a slate bed, the whole bed is frequently rich enough to be worked as a low grade ore. As will be shown further on, practical experience has taught the miner that profitable low grade ore means material yielding in an ordinary stamp mill from two dollars to the ton and upwards.

The early prospecting developed promising alluvial deposits at several points. At Tangier it was shown that a large extent of surface carried gold, and several hundred ounces were washed out.. The limited extent of the areas, however, did not allow of systematic work, and attention was diverted to the rich vein outcrops. The most interesting alluvial development was at the Ovens, near Lunenburg. Here the sea has worn a number of large cavities in the cliffs, which are composed of soft slates with small quartz veins often showing gold. The action of the waves concentrated the gold washed from the slates along the beach near these openings, and during the years 1861 and 1862 about 2,500 ounces were returned as taken out. It is believed, however, that only a small part of the gold extracted was accounted for. Since that date small amounts have been secured by persons living in the vicinity. The richness of the alluvium directed attention to the neighboring quartz veins, but they proved uncertain and unprofitable with the crude methods of that day. Trial crushings of the quartz and slate from several points in this district would indicate the feasibility of dealing with them on a low grade basis.

At Gay's River explorations have shown that a conglomerate of lower carboniferous age, lying on the gold bearing slates, carries at its junction with them considerable amounts of gold. At one time profitable mining was carried on here on a small scale along the edge of the outcrop of the conglomerate; but the miners turned their attention to richer districts. As the conglomerates at many points in this district show gold it is to be

regretted that more attention has not been paid to them, as in a certain degree a parallel can be traced between them and the South African gold fields.

Promising alluvial ground exists on the Nine Mile and Meander Rivers, at Renfrew, in the southern part of Waverley, and in the vicinity of other gold fields. In fact at any favorable point south of the passage of an auriferous anticlinal sights of gold can be obtained by panning, which would, in California or other countries where alluvial mining is a recognized practice, be given immediate attention by enterprising miners.

However, little attention has been paid to this source of gold for many years, although it has been well within the knowledge of miners that in every district the immediate surface cover contains much gold in boulders and free in the earth. At Moose River, Mr. Touquoy, a miner who acquired his experience in Australia, for a number of years systematically passed the surface earth of his areas through his crusher with profitable returns. There can be no doubt that at many points this system could be advantageously united, as in his case, with the crushing of underground quartz.

An Act has been passed to allow of large tracts of ground being taken on almost nominal terms for a period of three months, to permit of preliminary investigation for the purpose of alluvial mining. This arrangement allows capital to secure cheaply unbroken stretches of ground which, if found valuable, can afterwards be brought under the regular conditions of the Mines Act.

In this connection it is interesting to note that indications of gold deposits are found in alluvials outside of the recognised or working gold fields of the Province. Gold has been found in this manner in Digby County, along the Cobequid Mountains, in the northern part of Guysboro County, and in almost every river flowing from the Precambrian table land of northern Cape Breton. It is not known yet if this gold is derived from workable veins carrying free gold, from the schists which sometimes show gold, or from the oxidation of sulphurets which often form a considerable percentage of certain beds. At Middle River and Whycocomagh, in Cape Breton, free gold occurs in the quartzites and in quartz veins therein. At the latter place it also occurs in the sulphides with which many of the felsites, etc., are strongly impregnated.

There appear to be two sources of alluvial gold in the province, first the free gold-bearing veins of the Atlantic coast, and the auriferous mineralised deposits, also in places containing free gold, and presented over a large section of the province, hitherto generally considered valueless for gold mining.

HISTORY OF GOLD MINING.

The discoveries of the gold deposits of California and Australia had prepared the minds of Nova Scotians, and a tremendous excitement arose when the presence of gold in the province was established. It is true that the first reports were listened to with incredulity by those in power, but public opinion, inflamed by the sight of the beautiful specimens from Tangier, compelled a legal recognition of the various districts.

The first claims were limited in size, and operators soon gave them up. Gradually companies acquired control of areas, put up mills, and started with high hopes. In many cases large profits were realized for a time in spite of every form of extravagance, of poor mills, and of unskilled mining. This continued for a few years, when the laws of finance and mining resumed their sway. The veins opened on the richest points of the outcrop of their pay streaks gradually became too poor to pay ; the treasuries of the companies, after lavishing dividends from the proceeds of the richest ore, had nothing left for a rainy day.

In 1872 this state of affairs had very materially changed in one respect, the system of working the mines. The tribute system had come into practice, and company mining had been largely suspended. It became evident that many leads that were considered unworkable by the directors of a company yielded a profit to a party of tributors. The chief objection to the tributors was the desultory nature of their operations, which in many cases led to the flooding and the crushing of the outcrops of good veins.

However, the tribute system marked the commencement of a new era. The enterprising men among the tributors, left to their own scanty resources, found that economy was the mainstay of mining. So by degrees high explosives, improved pumping and hoisting machinery, air drills, better systems of working, and last but not least great improvements in mills and milling, were introduced, until the practice in Nova Scotia is fairly abreast of the times. As the success of many of the tributors became known, capital was gradually again available, and at the present time the greater number of the companies working in the province are successful whenever they have been started on a business basis and properly managed.

DISTRICTS.

It would occupy too much space to give a detailed notice of all the gold districts. I therefore give a very brief reference to the principal ones.

The best known districts are Wine Harbor, Stormont, Sherbrooke, Tangier, Montagu, Waverley, Renfrew, Oldham, Uniacke, Caribou, Lake Catcha, Brookfield, Whiteburn, Malaga, Fifteen Mile Stream, and Salmon River. Among others that have received more or less attention may be named Gegoggin, Ovens, Indian Path, Millipsigate, Gold River, Kemptville, Gay's River, South Stewiacke, Gold Lake, Killag, Beaver Dam, Ecum Secum, Harrigan Cove, Cow Bay, Lawrencetown, Rawdon, etc.

More or less detailed notices of all these localities can be found in the reports of the Mines Department. In the case of the minor districts, as may be gathered from preceding remarks, their development has been retarded by the persistence of the prospector in neglecting for years the problem of large supplies of low grade ore in favor of isolated rich veins.

Waverley.

Waverley was one of the earliest proclaimed districts. Rich boulders were found on "American Hill" in the fall of 1861, and shortly afterwards on Laidlaw's Hill, on the east side of the Waverley lakes. The latter place carried a valuable vein in a shape then new to miners, and attracted much attention. The vein was presented in a horse-shoe shape, with its apex pointing to the westward, and corrugated, like logs of wood lying side by side. During the next three years about 5,000 tons of quartz were extracted by open work along the crop, and good average returns secured, with some extraordinary yields, in one case of 200 ounces from two tons. Finally the surface water proved too much for the individual operators, and the workings were abandoned for many years. At present these properties and others have been consolidated, and a tunnel driven in to cut the lode at the level of the lake, and an extensive mining plant installed. As at this level and for some distance lower it is auriferous, it has again proved a valuable property. There are probably other unseen veins below this one which would give large backs above the level of the lake. In West Waverley the Burkner property was for some years a large producer, having yielded nearly a quarter of a million of dollars, as was also the DeWolf property, yielding about 9,000 ounces. Several companies on the American Hill were amalgamated in 1864, and yielded during that year a profit of $90,000. Other small operators in some cases did fairly well. These results were all obtained from shallow workings, in no case exceeding 300

feet. Up to 1867 there had been a yield of about 40,000 ounces of gold from 56,758 tons of quartz, from a narrow strip running through the district. The total yield up to date is 61,711 ounces, from 123,383 tons of quartz, or about $1,200,000.00.

Montagu.

The district of Montagu sprang into notice on the discovery of a boulder of quartz yielding $1,600.00 of gold. This led to the opening of the Lawson lode which, after a career unprofitable on an average yield of over two ounces to the ton, fell into the hands of the Lawson Brothers. They worked it for about five years and extracted 10,000 ounces. The Rose lead was discovered by Mr. G. W. Stuart in 1879, and yielded large returns for some time, notably on one occasion 800 ounces from 80 tons of quartz. Finally it was lost on a fault.

The DeWolf property, after an uneventful career for some years, became known as the Annand Mine, and gave large returns for some time, when, owing to the death of the proprietor, little work was done until it came into the hands of the present owners.

The Symonds-Kaye property has been intermittently worked. In this district operations have been confined to the south dip of the anticlinal, and there is a large unworked but promising field on the reverse or northerly dip. The yield of the district to date is 40,606 ounces, valued at $861,514.00, from 26,140 tons of quartz.

Oldham.

Work was begun in this district in 1862, and the following year saw eight crushers in operation. Up to 1884 an annual production of about 1,200 ounces was maintained, the yield in 1870 being 2,052 ounces from 2,644 tons of quartz. Among the leads worked during this period may be named the Britannia, Ohio, Sterling, Hall, Bonanza, Mayflower and Frankfort. At times very rich returns were made from small lots of quartz. Veins which passed obliquely from bed to bed were at one time quite extensively worked, and although small often gave rich returns, notably in one case 160 ounces from 10 tons of rock. The work in this district having been, during this period, largely in the hands of individual operators on small areas, the surface is greatly cut up, and the veins practically worked only along the outcrop. Some work was done on a cross lead in the eastern end of the district, and in 1883 the Dunbrack lode began to show valuable quartz. Operations were carried on briskly up to 1893, and the following returns were made:—

Year.	Tons.	Ounces.
1885	1,170	2,360
1886	1,026	2,199
1887	2,357	2,599
1888	2,106	1,699
1889	1,391	2,709
1890	1,122	2,774
1891	2,019	2,909
1892	2,259	3,093
1893 (9 mos.)	2,389	3,171

The operations of Mr. Hardman were profitable, and conducted with skill and economy; and this pleasing page in the history of this district is due to his enterprise and industry.

Operations in the leading mines were discontinued from causes other than the impoverishment of the properties, and little has been done since.

Mount Uniacke.

Mining began here in 1867, and during the next few years several companies were working; however, the returns, which rose in 1868 to 3,247 ounces, were maintained for twenty years at figures varying from 100 to 1,700 ounces. During part of this time considerable attention was paid to the slate belts which were found to carry regular values over considerable areas. It may be found that in this district the best returns will be secured from these belts which often carry veins, auriferous, but not constant in their dimensions or values.

About this time an important discovery on the Withrow areas at South Uniacke diverted attention to the new district. A vein which yielded excellent returns was worked by the Withrow Company, and its extension was mined first by Thompson and Quirk, and afterwards by the Golden Lode Company. All these parties realized profitable returns. Interesting information on the system of mining, etc., carried on by Mr. A. A. Hayward at the Golden Lode mine, has been contributed by that gentleman to the proceedings of the Nova Scotia Mining Society.

Renfrew.

Work was begun here in 1862, but little was done until 1866, when the returns showed 6,423 ounces from 6,003 tons of quartz. The following year showed an increase of 1,500 ounces, succeeded by a decrease to ten ounces in 1874. Since that date the yield has fluctuated up to 1,679 ounces. Among the earlier companies may be named the Hartford, Colonial, Ophir, Renfrew and McClure. In 1883 the Empress Company was started, and worked with much energy and ability. A suspension of activity followed

for some years ; but in the autumn of 1899 returns from the Big Five and Jubilee companies showed an extremely high grade of ore, one return giving from about 15 tons of quartz nearly $8,000.00.

A very rich strike was made on the property of the Messrs. Thompson in the spring of 1900, and up to date 272 tons have yielded 5,071 ounces, or about $100,000.

CARIBOU.

This district includes the two districts generally known as Moose River, and Jennings, or Caribou. It was proclaimed in 1870. The returns, although not large for a number of years, showed good averages, and in many cases proved satisfactory. The North, South, Hyde, Comstock and other leads were worked, often with good returns.

In 1881 the Moose River Gold Company carried on extensive workings, but they were abandoned, as the value of the leads diminished. Before closing, however, this company demonstrated that it had extensive deposits of low grade ore on its property. Since then large amounts of this low grade ore have been passed through their ten stamp mill by Mr. McGregor, and show an average of about six pennyweights to the ton. As these operations were profitable on a small scale there should be an opportunity for systematic working. On the Touquoy and adjoining properties there appear to be similar supplies of low grade ore in addition to workable veins, which are being extensively developed by the Touquoy Gold Mining Company, the Colonial Mining Company, and others. The slate and surface earth of the Moose River district has received much attention so far, and with satisfactory results, even on a very small scale of working, and in this connection the following figures are interesting. There were crushed in the Moose River mill from 1881 to date 38,054 tons of slate and low grade ore, with some lots of richer quartz, yielding 11,154 oz., 19 dwt., 13 gr.

The returns made by Mr. Touquoy, from his ten stamp mill, from 1888 to 1898, including some lots of fairly rich quartz, show that 60,943 tons of slate and surface ground yielded 8,640 ounces, an average of about 2 dwts. 20 grains. This work yielded a uniform profit, and lower averages per ton will be shown further on to have also yielded a profit.

In Caribou in 1884 the Lake Lode mine was opened by Mr. Stuart, and worked by Mr. Wadsworth and by Mr. Saunders, and is now being extensively developed by the Guffey-Jennings Gold Mining Company. Large amounts of gold have been taken from this property, and a bright future is anticipated for it. In the same locality the Dixon, Truro, Hetherington, McDonald, Elk and other mines have been opened and worked successfully. Up to date about 124,500 tons of quartz have yielded 41,814 ounces, valued at $794,472.42.

Sherbrooke.

Among the veins that have been worked may be mentioned the Cumminger, Hewitt, Hayden, Blue, Palmerston and Dewar. The following table shows the returns year by year from the district :—

Year.	Tons.	Ounces.
1862	663	2,023
1863	3,454	3,304
1864	2,673	3,419
1865	2,511	3,424
1866	2,853	5,829
1867	7,378	9,463
1868	9,880	7,070
1869	11,500	5,546
1870	11,428	7,134
1871	13,882	6,579
1872	5,243	4,188
1873	7,187	5,026
1874	5,430	4,037
1875	6,443	5,818
1876	6,205	5,176
1877	8,654	8,237
1878	9,340	6,843
1879	9,209	7,389
1880	6,465	4,042
1881	5,277	2,580
1882	6,251	2,542
1883	8,470	3,356
1884	3,268	2,668
1885	2,426	1,238
1886	2,850	1,341
1887	2,413	585
1888	2,858	535
1889	1,618	243
1890		
1891	464	119
1892	893	179
1893		
1894	708	552
1895	3,397	1,942
1896	7,177	3,287
1897	12,659	4,181
1898	16,891	5,201
1899	18,437	5,118
1900	17,711	4,763

representing a total value of about $2,629,729.00.

The quartz mined in this locality has generally been of a high grade, and there can be no doubt that there are many more rich pieces of ground. The

district moreover presents several localities which should be profitably worked on a low grade basis.

Wine Harbor.

This district for a few years during its early history yielded some good returns, but for a number of years past attempts at development have not been markedly successful. No reason can be given for this, as the geological conditions are apparently the same as elsewhere, and some of the veins were profitably productive. The total returns to date are 26,872 ounces from 49,070 tons of quartz.

Salmon River.

This district was opened in the year 1880, and work commenced in 1881 with a twenty stamp mill driven by water power. The yield for that year was 1,758 ounces. The following year the Hattie mine was opened on what was believed to be the eastern extension of the Dufferin vein, but the operations were not long continued In 1885 operations had reached a depth of 150 feet; the vein had been followed for nearly a thousand feet, and the yield that year was 4,924 ounces from 10,880 tons of quartz. Increased power having been secured, the mill, which had for some years contained thirty stamps, had its capacity increased by ten.

This vein, which in structure is very similar to the saddle back veins met in the Bendigo gold district, Australia, has been one of much interest to miners. It showed at the surface, and on being followed down it divided, going down on each side of the anticlinal, and increased in thinness, giving in places over fifteen feet of crushing material.

The working of the mine has been discontinued more or less during the past few years owing to change of ownership and litigation, but at the date of writing it has been reopened and provided with a thoroughly good equipment, and will, it is hoped, resume its leading position among our gold mines.

The following are the returns received, almost exclusively from the Dufferin mine :—

Year.	Tons.	Ounces.
1881	1,640	1,785
1882	3,460	4,315
1883	7,602	3,885
1884	9,799	3,397
1885	10,880	4,924
1886	11,628	6,509
1887	10,602	3,258
1888	9,925	3,354
1889	7,633	2,032

Year.	Tons.	Ounces.
1890	6,415	2,070
1891	5,210	1,406
1892	4,220	1,042
1893	3,220	882
1894		
1895	1,467	271
1896		
1897		

Tangier.

For the first few years operations were much hindered by the numerous small areas held by individuals. The greatest production was during the years 1869-70-71, when 6,988 tons of quartz gave 5,099 ounces During all other years the yield has been under one thousand ounces. Recent developments in the northern part of the district, and a short distance east of the Tangier River, promise a development on a larger and more permanent scale. The total returns to date are 22,831 ounces, valued at $433,802.90, from 46,938 tons of quartz. In this are included the returns from the Mooseland mines in the northern part of the district, which has not yet received the attention it deserves.

Fifteen Mile Stream.

This district, situated at the head waters of the Sheet Harbor River system, has always been largely an object of interest to the people of Pictou County. Its comparatively inaccessible position retarded its development for a number of years, but roads are now built into it, and during the past few years its undoubted value has been shown by the enterprise of New Glasgow capitalists. The following sketch of the principal mine operating in the district will be of interest :—

In 1886 the Egerton Gold Mining Company succeeded the Hall-Anderson Company at Fifteen Mile stream. They worked with a 10 stamp mill for four years and were fairly successful. In 1890 the "Egerton" sold out to the present proprietors, who organized the New Egerton company, and placed Mr. James A. Fraser in charge as manager. A new 15 stamp mill was at once erected, and the new company was soon on a good paying basis. During the first two years (1890 and 1891), nearly 4,500 ounces of gold were secured. Though operations were confined during the next two or three years mainly to developing the property, the yield of gold continued sufficient to meet all running expenses and pay for extensive improvements in machinery, etc. In 1893 an amalgamation was effected with the Stanley Gold Mining Company, which had been operating for some time in the district, and had erected a large dam and a 10 stamp water mill. During

the years 1895-96, and the early part of '97, the company was particularly successful, the yield of gold for 2½ years averaging 225 ounces per month. In the summer of 1896 a new 30 stamp mill had been built, thoroughly equipped with new air compressor, etc. The first half of 1897 saw great attention paid to development work under the guidance of an experienced mining engineer. Notwithstanding this the mine continued yielding its regular returns till a severe crush in October caused a temporary abandonment of work. In May of the following year operations were resumed on an open cut with a belt of over 120 feet.

A Ledgerwood overhead cable-way has been put in, succeeding the old fashioned tramways as a carrier of rock to the mill. Ten additional stamps have been placed in the Stanley mill, which is now being operated with 20 stamps. This, with the 30 in the "Egerton" mill, makes a total of 50 stamps.

The property of the company embraces 300 mining areas at Fifteen Mile Stream, together with 4,000 acres of woodland from which fuel is obtained.

In 1896 the company was incorporated under the laws of Nova Scotia as the New Egerton Gold Mining Company, (Limited).

The returns of this company show that since their purchase of the Hall-Anderson Company property, 35,698 tons of quartz have yielded 17,617 ounces of gold.

Lake Catcha, (Chezzetcook.)

The first mention of this district appears in the Mines Report for the year 1882, when the Oxford Gold Mining Company erected a complete milling and mining plant, with the necessary stores, dwellings, etc., and commenced mining operations. Other parties did considerable work during the same year. In the following year the same Company produced nearly 2500 oz. of gold from 1475 tons of quartz.

In 1884 the Oxford Co. had gone ahead in their development work to such an extent that they were spoken of as owning one of the best mining plants in the Province.

A 10 stamp mill was built during the year 1886 by the Cambridge Company. Work was continued by the Oxford people, who in 1886 discovered a new and very rich lead. Up to the year 1888 over 40 leads had been cut on the Oxford property, and by 1891 the Company had discovered over 100 leads and done a large amount of development work. More or less work has also been done in the district by Jno. H. Anderson, Dr. Cogswell and others. During the present year considerable development work has been done in a new part of the district and some of the old properties have been re-opened. The prospect for the district appears to be promising.

The returns from this district have not appeared in separate form in the

Mines Report for those years during which it has been worked only to a limited extent. The total returns show that 23,023 tons of quartz have yielded in round numbers 24,340 oz., valued at about $462,467.

STORMONT.

The returns to date from this district show 66,545 ounces from 176,170 tons of quartz, etc. The history of this district for many years was similar to that given of the others. Some rich leads were worked profitably, but their abandonment left the district non-productive for a time. Attention has however been always directed to it as frequent rich returns were made from new veins, and numerous indications of gold bearing veins were found over a tract several square miles in extent. Finally a new anticlinal system, known as the Richardson, was found to the north of the Mulgrave or Isaac's Harbor anticlinal. A number of mines have been opened on these and on the Country Harbor Narrows and Forrest Hill anticlinals. The Doliver's Mountain and Richardson section present large and strong veins and belts, holding good gold values and highly mineralized. There is undoubtedly room here for several mines like the Richardson, worked, however, with more attention to the tailings and concentrates. The workings of the Richardson mine, of which I give a few details further on, are of particular interest, as they have materially added to the proof that we can mine and work profitably deposits which a few years ago were considered beneath the miner's notice.

The output of the Richardson mine to date has been 21,623 ounces from 240,356 tons of quartz—and of the district, 66,545 ounces of gold, valued at $1,264,370.90.

The following remarks from the paper by Mr. Andrews, referred to elsewhere in this report, are interesting:—

"The Richardson belt is very heavily mineralized; and there is great cause for regret that only the free gold is saved. The results of a careful and elaborate series of tests of the tailings from this mine made by Mr. F. H. Mason, are somewhat surprising to many who do not consider the auriferous ores of Nova Scotia worth concentration. But facts speak loudly for themselves, and, much as we would like to have all our ore free milling, the desire does not alter the refractory nature of some of it.

"According to these tests, made when the ore being crushed was of an unusually low grade, the average loss was 1 dwt. 18 gr. per ton, A sample of tailings from which all the concentrates were not extracted gave 1.3% of concentrates, which had an assay value of 1 oz. 10 dwt. 1 gr. per ton, and still left a value of 1 dwt. per ton in the tailings. Another sample of tailings gave 6.3% of sandy concentrates, having an assay value of 1 oz. 1 dwt. 13 grs. per ton of concentrates. In neither sample was free gold or amalgam detected. The majority of the arsenical iron pyrites is contained in the slate; some samples of this slate assay very high. A chance sample gave the surprising result of 28 oz. 8 dwt. of gold to the ton of concentrates,

and yielded 30% of its total weight in concentrates. Two more assays of this slate gave concentrates valued respectively at 4 oz. 2 dwt. 8 grs. and 5 oz. 6 dwt. 12 grs. per standard ton of concentrates. As this slate contains so little free gold but a small portion of it is crushed.

"Near the surface the slate is soft and partly decomposed. In this condition it yields considerable free gold when milled. As the depth increases the slate becomes harder, increasing perceptibly in bulk, and in the quantity and quality of its concentrates. Below a depth of about 100 feet it contains so little free gold that it is unprofitable as a free milling ore.

"An analysis of clean concentrates taken from the sluices of the mill gives the following composition :—

Silica	2.65
Iron	35.63
Sulphur	16.80
Arsenic	42.25
Copper	trace
Bismuth	"
Zinc	nil.

An assay of these concentrates gave 2 oz. 14 dwt. 21 gr. of gold per ton. A chlorination test of these concentrates obtained an extraction of 97% of gold contained.

"The cost of an eight or ten ton chlorination plant erected in Nova Scotia will be about $4,000, exclusive of building."

"Up to the present time this property has produced 43,000 tons of ore, which goes to show that the mining of low grade ores in Nova Scotia at a reasonable cost per ton, has got beyond the experimental stage and is a reality. The handling of the refractory ores has yet to be experimented with, and from the appearance of nearly all the ore that I have seen along the Gold group anticlinal, I am of the opinion that material for the experiment is not lacking."

I am able to give the following interesting figures :—

HALIFAX, May 30th, 1898.

Dr. E. Gilpin, Inspector of Mines :

DEAR SIR,—

As promised, I beg to furnish you with an exhibit of the operations of above company for the year just closed, as follows :

FORTY STAMP MILL.

Total tons crushed	25,300 tons.
Total gold won	2,879 oz.
Product per ton	2 dwt. 6⅔ gr.
Cost per ton, labor	$1.15⅓
" " all charges, including renewals to machinery	$1.83⅓

For the past year, after providing and paying for every dollar of expenditure in connection with the running and thorough maintenance of the property in the highest state of efficiency, and leaving a balance of several hundred dollars on hand, the original shareholders have received dividends equal to 29½% on their outlay.

Yours truly,

J. W. CRICHTON,
Secretary.

Cost of working and all expenses in connection with the "Richardson Mine," Isaac's Harbor, Nova Scotia, for month of May, 1898, embracing everything except insurance and wear and tear of machinery.

WAGES AS FOLLOWS:

14 Drill men	$475 25	
23 Rock men	615 90	
4 Deck hands	102 00	
5 Quarry men	163 40	
2 Engine drivers at pit	83 70	
2 Timber men	66 70	
2 Brakemen at pit head	61 80	
2 Trolley men " "	59 85	
1 Foreman	48 00	
1 Night foreman	39 00	
2 Blacksmiths	96 20	
2 Teamsters	78 15	
1 Chief Engineer	55 00	
1 Amalgamator	51 00	
2 Engine drivers at mill	78 50	
2 Carpenters	68 40	
8 Mill hands	219 90	
Management	100 00	
		$2,462 75

OTHER EXPENSES.

140 Tons coal	$182 00	
19 Boxes candles (570 lbs.)	171 00	
Half jar quicksilver (37½ lbs.)	20 62	
Oil	10 00	
Wear of shoes and dies	50 00	
Cams and tappetts	50 00	
Waste	5 00	
Timber	10 00	
Shovels, picks, drills and handles	15 00	
Dynamite, fuse and caps	111 57	
Horse feed	60 00	
Royalty	101 80	
Miscellaneous	25 00	
		$ 811 99
Total		$3,274 74

Total tons crushed	2,266
Result of 25 days' crushing 282¾ ounces gold at $19.00 per ounce	$5,372 25
Cost per statement	3,275 14
Profit for May	$2,097 11

A. B. COX,

Isaac's Harbor, June 6th, 1898. *Manager.*

In the Western part of the province Malaga, Brookfield and Whiteburn have been the largest producers. These districts are comparatively new, and at first some very promising veins were opened and extensively worked, but little is now being done at Whiteburn and Malaga. Brookfield is interesting as it has the first chlorination plant built in the province. This was put up by Mr. W. L. Libbey and associates, and is run in connection with a valuable property owned by them. This plant has been in successful operation for some time. Mr. Libbey is prepared to treat, on reasonable terms, any parcels of concentrates that may be forwarded to him, guaranteeing an extraction of 90 per. cent of the assay value. He is also prepared to make working tests of small quantities of ore as to their adaptability for chlorination, etc. This should supply a favorable opportunity to our gold miners to get information as to the value of their concentrates. Mining has also been carried on at Leipsigate, Gold River, Block House, and a number of other places in Lunenburg and Queens Counties, but they have not yet been worked on a scale commensurate with their promising indications. There is no doubt that all these districts would repay proper examination and development, as they differ in no respect, that I am aware of, from those opened to the east of Halifax.

Among the other districts that of Central Rawdon is interesting. Here the veins run across the measures, and two of them are found to unite in depth, thus reversing the method in which they are often presented in the other districts. Since 1880, 4,814 tons of quartz yielded 6,648 ounces of gold.

MINING.

At many of the mines shafts are sunk at the proper places, and ground systematically blocked out, and the operations underground are carried on with economy and system. Properly designed machinery is largely used for pumping, hoisting and crushing, and the mills are carefully built, and run with proper attention to the details essential to this metallurgical process, which is really much more complicated than would be believed from a casual glance at a mill. Interesting details on the best system of milling the quartz of this province are given by Mr. Hardman in a paper published in the Transactions of the Nova Scotia Institute of Mining Engineers, for the year 1892-93. These Transactions give many other interesting papers touching on gold mining practice in our gold fields. It can be said for the benefit of investors, that our gold mine managers can stand comparison with those of any other country in their ability to mine systematically, and to treat economically the extracted material.

To show this, I quote from a paper read by Mr. A. A. Hayward at a late meeting of the Nova Scotia Mining Society, in which he gave his experience in shaft sinking at South Uniacke and Montagu. At South Uniacke it was decided to sink a five feet six inch by twelve feet shaft 404 feet through hard quartzite. The work was completed in 140 days, of which 16 were occupied in timbering. The average rate sunk was 3.02 feet per day ; the total cost of explosives per foot sunk was $1.22 ; and the average monthly rate of sinking was 71 feet 6 inches, the highest rate being 85 feet in one month. The total cost, including management, fuel, and everything chargeable to the shaft, was $4,647, or $11.50 per foot, the shaft being left completed, timbered, and ready for occupation.

At Montagu, during 1897 the shaft of the Golden Group Company was sunk 100 feet below the 200 feet level. The work would have been finished in 25 days, had several days not been lost in taking down and saving a small rich lode on the foot wall. The cost of this sinking per foot was a little in excess of that at Uniacke. These two instances show that the ordinary cost of sinking can be most materially reduced when the work is fully planned out, and carried on systematically.

A paper read by Mr. W. L. Libbey at the same meeting, gives some interesting figures as to his experience in mining and milling at Brookfield, Queen's County. He compares hand and machine drilling as follows :—

In making comparisons with the cost of landing ore at the rock-breaker on other mines, it must be remembered that the fissure vein at Brookfield averages not over 24″ in width of crushing material. The extreme depth perpendicularly of the working of the mine is 450 feet. The figures given

include the cost of sinking and drifting, and also in the first table is covered the cost of excavating a large chamber to hold a double plunger Northey pump, and a cistern capable of holding mine water for twelve hours.

During six months, from May 1st, 1897, to November 1st, 1897, 5,606 tons of ore were sent to the mill at an average cost of $2.54 per ton, as follows, for ore landed at the rock-breaker :—

Labor (which includes blacksmiths and deck men)	$11,173 99
Timber and poles	392 40
Shovels	35 20
Picks	20 60
Blacksmith's coal, 6 tons at $10.66 per ton	63 96
Charcoal, 300 bushels at 15c. per bush.	45 00
Axes	5 00
Hoisting ropes (estimated)	50 00
Candles	364 29
Loss of steel	71 82
Fuel at pumping station and mill	1,046 00
Explosives	654 75
Iron, including rails for tracks	126 70
Miscellaneous expenses	125 00
Lumber	45 00
Total	$14,219 91

Following are the figures for three months of work with the air plant. It should be borne in mind that not only have green men been broken in, but the method of stoping is being gradually changed from breast stoping to back stoping. The results are especially gratifying to the Brookfield Mining Co., as many old timers have flatly stated that a small lead could not be worked as cheaply by an air plant as by hand labor, and in one instance recently an air plant has been discontinued and a return made to hand drilling. The months taken are January, February and March, 1898, during which time 2,840 tons were sent to the mill at an average cost of $2.44 per ton, as follows, for ore landed at the rock-breaker :—

Labor (which includes blacksmiths and deck men)	$5,078 95
Timber and poles	198 80
Shovels	10 00
Picks	2 00
Blacksmith's coal, 4½ tons at $10.66	47 97
Charcoal, 150 bushels at 15c	22 50
Hoisting ropes	25 00
Candles	171 00
Loss of steel	11 25
Fuel at pumping station and mill	717 00
Explosives	512 50
Iron, including rails for tracks	43 45
Miscellaneous expenses	75 00
Lumber	25 00
Total	$6,940 42

The result thus far is apparently to place our ore at the deck head ten cents per ton cheaper with an air plant than by hand work. We are, however, doing more than twenty-five per cent. more of sinking and drifting with the air plant than formerly by hand. In fact, it would be impossible to place men enough in the mine to equal by hand the work now done by power.

Following is a table showing the expense of running the 20 stamp mill for six months, commencing September 1st, 1897, and ending February 1st, 1898. During this time 5,910 tons of ore were milled and concentrated at an average cost of 60 cents :

Fuel	$876 00
Labor—2 firemen	360 00
" 3 amalgamators	900 00
" 2 concentrator boys	252 00
" 1 carpenter	242 65
" 1 engineer	300 00
Miscellaneous expense, including lubricants	75 00
Cost total for shoes and dies	397 53
Mercury lost, 79¼ lbs. at 60c	47 55
Screen wire, 192 ft. at 50c	96 00
Total	$3,546 73

At the Richardson mine, Stormont, the lead has been found to be from 6 to 18 feet wide. In 1894 the mill contained twenty stamps, and the cost of mining and milling was $2.90 per ton, inclusive of taxes, insurance, depreciation, and all charges. The belt was composed for the most part of one large lode from 1 to 4 feet in thickness, and a varying number of small lodes intermixed with slate. In places nearly the entire belt is quartz. The slate is auriferous as well as the quartz. Shortly after that date, the mine was remodelled in every respect, so that nine hand drills could produce regularly 2,000 tons of ore per month. The mill was enlarged to 40 stamps of 850 lbs. weight each, dropping 99 times per minute, and crushing very finely. With this plant, lighted by electricity, and driven by a central engine, the cost of mining and milling, including all charges, was $1.65 per ton. The belt is very heavily mineralized, and the concentrates show gold up to 5 oz. per ton.

The paper from which these brief extracts are given was read by Mr. C. F. Andrews, at the Montreal Meeting of the Canadian Mining Society in 1897. I may add that arrangements are now being made to save and treat the concentrates, which should yield a considerable additional profit.

GENERAL REMARKS.

The climate presents no obstacles to mining, and operations are carried on throughout the year. There are no heavy falls of snow, and no heavy freshets, or rainy seasons. The mines themselves are with very few exceptions dry, and pumping charges are not heavy, when proper provision is made for diverting the surface water. All the districts are accessible by roads passable for heavy loads; some are close to railways; and many are on tide water, or only a few miles removed from it. Few, if any, gold mining districts are more favorably situated for procuring supplies. Mills, boilers, engines, and all the innumerable mechanical aids to mining are manufactured in the country, and within short distances of any district. Labor is plentiful. The men are quiet and orderly, and no communities are more law-abiding than our mining villages, which are always provided with schools, and frequently with churches. The men are intelligent and good miners, and in the mining districts of Western America they are preferred to all others.

It will be observed from the preceding notes that there are three additional openings for extending the operations of the gold mines in this province: treatment of the tailing and concentrates, alluvial mining, and the development of what might be termed the gold in the mineralized deposits, in part only free milling.

As to the first of these openings, the treatment of the tailings and their concentrates, it may be remarked that its feasibility has been demonstrated at the Brookfield mine, and the reports of the assayers show an equally good opening for the treatment of this material by chlorination, or an allied process, in every district.

It is true that the expense of these plants may preclude their adoption by many of the smaller mines and districts. As however, the greater number of the districts are readily accessible by water or railroad, it would appear that, if even the concentrates were saved and shipped to a chlorination plant, located at a convenient point, the Government would receive an increased royalty, and many mines would have an important additional source of revenue secured to them. It is the generally expressed opinion of all who have looked into the matter that such a plant, for the treatment of concentrates, located at Halifax, would greatly benefit the mining community.

The subject of the third opening has as yet received comparatively little attention. It is known that at a number of places in the province, veins and beds, carrying as essential ingredients lead or copper ores, or both, con-

tain gold and silver in amounts commercially valuable. It is also known that there are other localities in which there are deposits, sometimes showing free gold, which carry gold and silver in the sulphurets in amounts sufficient to warrant their reduction where the percentage of the concentrates is high enough. Localities coming under this latter classification occur in the Cobequid Mountains, in the counties of Pictou and Guysboro, and in northern Cape Breton. In the first and last named districts the streams show sights of gold, and a certain amount of free gold occurs. In the Whycocomagh, Middle River, and Cheticamp districts, there are extensive mineralised zones in the Precambrian rocks, which present a good field for investigation. Free gold occurs in the alluvium in promising amounts ; fine free gold is seen in the silicious beds, and the sulphurets carry gold. Given these data it would appear reasonable to expect that no great amount of prospecting should disclose localities for profitable mining. Examination will probably reveal points where a more particular enrichment has been caused by dykes, etc., and the mining developments of Western America will find a parallel in Nova Scotia.

CONCENTRATES.

Mr. F. H. Mason, Metallurgist, of Halifax, has kindly contributed to this report a memo. on the tailings and concentrates of our Nova Scotia gold ores, as follows :—

Until the beginning of the year 1897 it may be said that no systematic attempt had been made to obtain anything but free milling gold from the ores of Nova Scotia. The class of machines used was the "Golden Gate," a machine requiring constant attention, and even then giving results far from being satisfactory. Notwithstanding the disadvantage resulting from the class of machine employed, the concentrates obtained in a custom mill at Oldham were of such a high value that it is surprising that attention was not given to the concentrating of tailings in other parts of the province at a much earlier date. The average value of the concentrates obtained at Oldham was from sixty to seventy dollars per ton of 2,000 lbs. I am given to understand, however, that no systematic record was kept of the percentage of concentrates saved, nor of the gold lost in the tailings after they had been over the concentrators.

At the Lake View Mines at Waverley, eight Frue Vanners were erected to treat the tailings from 30 stamps, or two-thirds the number required by good practice. So that here, although the class of machines was excellent, the number of machines was insufficient to handle the quantity of tailings going over them, and good results were consequently not obtained. The

value of the concentrates, which at times contained a considerable proportion of sand, ranged from eight to thirty dollars per ton.

About 1881 W. A. Mirral of Colorado, started a chlorination plant at Waverley. The plant consisted of a very small hand roasting furnace, and a home made Plattner Chlorination plant of the crudest description. The whole thing proved a complete failure. Two years later B. A. Temple of Waverley joined Mirral, and put in a new furnace and new leaching and precipitating vats, &c., to start a Plattner plant. I have examined this plant and have never seen or read of anything quite like it.

The early attempts at cyaniding met with a fate similar to that of chlorination. Dr. Kendall and his assistants came from the States and erected a plant at North Brookfield, with a view to treating an old tailing dump at that time (about 1893) owned by the Brookfield Gold Mining Associates. Dr. Kendall experimented for some time without obtaining any results, and the Brookfield Associates who had employed him, gave him notice to quit, and continued the researches themselves for some time with no better results, and the attempt was abandoned.

These early failures naturally had a bad effect upon this branch of the gold mining industry, and gave the general public the false impression that even if the concentrates of Nova Scotia contained gold, it would cost more to extract it than the gold was worth, and the concentrates were allowed to go away with the tailings down streams and amongst brush wood, never to be recovered. At the time of my arrival in the province it had become generally recognized that the ores of Nova Scotia were free milling ores, and that gold which could not be saved in the mortars and on the plates of the stamp battery was not worth saving.

I at once turned my attention to studying the remarkable phenomenon of a country with a large area of auriferous formation, in which all the gold was said to be of a free milling nature, with a view to establish either the truth or fallacy of this then generally recognized opinion. By obtaining samples of a number of old tailing dumps and making a number of careful assays of them, I soon discovered the complete error into which the gold mining fraternity of Nova Scotia had fallen. Assays of these samples gave from two dollars to seventeen dollars per ton. Of course in many cases a natural concentration had taken place, and these samples did not represent actual losses in the mill, but it did clearly prove to me that considerable quantities of gold were being lost, a large percentage of which might have been saved by the employment of proper machinery.

During the last five years I have made a large number of assays of tailings taken both directly from the end of the plates and also from dumps. I have also assayed a number of samples of concentrates.

The following table of maximum and minimum results from different districts will be of interest:

DISTRICT.	Tailings from Plates.		Tailings from Dumps.		Concentrates.	
	Maximum.	Minimum.	Maximum.	Minimum.	Maximum.	Minimum.
Cow Bay	1 dwt. 18 grs.	21 grs.				
Sherbrook	3 dwt. 12 grs.	21 grs.	6 dwt. 10 grs.	3 dwt. 6 grs.	1 oz. 8 dwt.	1 oz. 8 dwt.
Caribou	2 dwt. 22 grs.	14 grs.	13 dwt. 2 grs.	2 dwt. 23 grs.	12 oz 0 dwt. 20 grs*	2 dwt. 22 grs.
Uniacke	8 dwt. 4 grs.	21 grs.			13 oz 3 dwt. 3 grs.	1 oz. 17 dwt. 21 grs.
Stormont	15 dwt. 8 grs.	1 dwt. 18 grs ‡	16 dwt. 22 grs.	3 dwt. 6 grs.	136oz. 1 dwt. 19grs*	1 oz. 7 dwt.
Brookfield			13 dwt. 1 gr.	14 grs.	12 oz. 17 dwt.	1 oz. 3 dwt.
Waverley	2 dwt. 15 grs.	21 grs.	6 dwt. 12 grs.		4 oz. 14 dwt. 1 gr.	1 oz. 8 dwt. 7 grs.
Central Rawdon	2 dwt. 22 grs.	traces.	14 dwt. 17 grs.	4 dwt. 16 grs.	5 oz. 15 dwt.	1 oz. 2 dwt. 4 grs.
Wine Harbor	3 dwt. 12 grs.	1 dwt.	6 dwt. 17 grs.	3 dwt. 12 grs		
Tangier	1 dwt. 4 grs.	21 grs.				
Fifteen Mile Stream.	13 dwt. 10 grs.*	7 grs.	19 dwt. 20 grs.	7 dwt.		
Oldham					3 oz. 8 dwt.	1 oz. 8 dwt. 4 grs.
Gold River			7 oz. 12 dwt. 20 grs.*			
Lunenburg County					99 oz. 16dwt. 18grs*	21 oz. 1 dwt. 8 grs *
Montague	8 oz. 2 dwt. 8 grs.*	1 dwt. 4 grs.	7 dwt.		7 oz. 11 dwt. 16grs	5 oz 9 dwt. 16 grs.

*Contained amalgam in appreciable quantities.

†Tailings from ore containing upwards of 40 per cent mispickle.

‡The ore was giving only $2.00 in free milling gold at time the tailings were taken.

The results given in the foregoing table clearly show that the stamp mill only saves a part of the gold present in our Nova Scotia ores. It is true in many cases a greater percentage of gold might have been saved by more skillful crushing and amalgamation, but on the other hand it clearly shows the large amount of gold which is going to waste for the want of proper appliances to save it.

Concentrators have now been running for some time at North Brookfield. At Central Rawdon the ore gives 4% of concentrates, having an average assay value of $30 in gold and $1 in silver. I am unable to give any values obtained at Brookfield, as the Brookfield Gold Mining Co., Ltd., refuse to give any information on the subject.

Another considerable source of waste in Nova Scotia gold mining is to be found in the waste rock dumps. At many times it has been the custom to dump and stow away on the scaffolds nearly the whole of the slate rock mined, much of which is often auriferous. In a paper read by Mr. C. F. Andrews he gave assays made by himself of rock taken from the waste dump at the Richardson mine. These samples were not average samples of the dump, but were taken on account of the large proportion of mineral (mispickle) contained in them.

The following are the assays and per centage of concentrates :

1. Contained 30% of concentrates, having an assay value of 28 oz. 8 dwts. of gold per ton.

2. Assayed 11 dwt. 2 grains per ton, contained 12.05% of concentrates, having an assay value of 4 oz. 2 dwt. per ton.

3. Assayed 17 dwt. per ton, contained 15% of concentrates, having an assay value of 5 oz. 6 dwt. per ton.

Mr. Dimock milled a trial lot of slate rock taken from his scaffolds at the Central Rawdon mine which he had previously been in the habit of dumping and stowing. The result was a saving of 60 cents per ton in the mill, while the tailings contained $2.60 per ton.

Undoubtedly many other mines might obtain similar results from material which at the present time is being piled on the waste rock dump or stored on the scaffolds under ground.

I have made a large number of experiments in my laboratory upon concentrates from all parts of the province, and up to now I have not come across a single instance in which any difficulty has been found in obtaining from 90 to 96 per cent. of the assay value by chlorination. Cyanide, on the other hand, has not proved so satisfactory. In one case I obtained a 94% extraction. With this exception 78% is the best extraction I have obtained, while in many cases the extraction has fallen below 30%, even with prolonged treatment lasting over 30 days.

There are other sources of gold in Nova Scotia which up to now have received no attention. The stibnites of East Gore are highly auriferous,

running at times over 50 ounces of gold per ton and showing no free gold by panning. In several samples of copper pyrites I have found over half an ounce of gold per ton. The fahl ores of Cheticamp have assayed as high as $15 in gold, while samples of rock carrying pyrrhotite have at times run over half an ounce. All of these, especially the first named, will pay for further investigation.

The foregoing remarks of Mr. Mason are interesting and important, and should be carefully considered by our gold miners.

The following table shows the production of the Nova Scotia mines for a number of years. The annual production has varied from 7,275 ounces in the year 1872, the first year during which official returns were made, to the year, 1867, which showed an output of 29,314 ounces. For some years past the production has been in the vicinity of the last named amount, although derived from a much lower average yield per ton of quartz. Thus in 1867, there were 31,386 tons of stuff crushed for 27,314 ounces, while in 1897 there was a return of 26,579 ounces from 76,559 tons of stuff.

NOVA SCOTIA GOLD.

PRODUCTION BY DISTRICTS FROM 1862 TO SEPT. 30, 1900.

DISTRICT.	Tons Crushed	Total Yield of Gold.			Average Yield per ton.			Value @ $19 per Oz.
		Oz.	Dwts.	Grs.	Oz.	Dwts.	Grs.	
Caribou & Moose River	124500	41814	6	18	..	6	17	794,472.42
Montague	26140	40606	10	14	1	11	1	771,524.06
Oldham	48243	52382	....	12	1	1	17	985,258.48
Renfrew	48601	38320	4	..	..	15	18	728,083.80
Sherbrooke	226169	128406	16	9	..	12	5	2,629,729.56
Stormont	176170	66545	16	3	..	7	13	1,264,370.32
Tangier	46938	22831	14	15	..	9	9	433,802.90
Uniacke	54362	38509	15	7	..	14	4	731,685.53
Waverley	123383	61711	15	5	..	10	..	1,172,523.45
Salmon River	117175	41487	5	20	..	7	2	788,258.55
Brookfield	43975	21098	17	22	..	9	14	400,879.03
Whiteburn	6394	9554	17	18	1	9	21	181,542.87
Lake Catcha	23023	24340	8	5	1	1	3	462,467.80
Rawdon	12178	9594	15	10	..	15	18	182,300.65
Wine Harbor	49070	26872	8	2	..	10	22	510,575.68
Fifteen Mile Stream	32893	16403	9	5	..	9	23	311,665.75
Malaga	20292	18563	2	8	..	18	7	352,699.22
Other Districts	81800	48837	6	5	..	11	22	927,908.90
Total	1261306	717881	10	10	4	.....	....	13,639,748.97

NOVA SCOTIA LEAD ORES.

As yet little has been effected in the development of the ores of this metal in Nova Scotia. They occur principally in two geological horizons, the Lower Carboniferous or mountain limestone, and the Precambrian or Laurentian. As the former horizon in other countries has yielded productive deposits of galena, some attention has been paid to it here in this respect. Observation has shown that at many localities lead ore is more or less distributed through the limestones. Among the places showing it may be mentioned the East and West Rivers of Pictou county ; Gay's River and Musquodoboit, Halifax county ; Smithfield and Pembroke, Colchester county ; Milford Haven, Caledonia and Salmon River, in Guysboro county ; and numerous points in Cape Breton Island. At Gay's River it occurs over a large tract of country, in limestone, disseminated in small crystals, in small nodules, and occasionally in thin veins. The average percentage at any place is small, and carries, I believe, up to 15 ounces of silver to the ton of lead. At Smithfield and Pembroke it occurs in greater quantity, and a considerable amount of exploratory work has been done. Here it is found in limestone also, apparently replacing it in part, and as a residual concentration from the removal of the rock. A very considerable amount of lead ore has been shown here at one point, but as the silver contents of the ore were not high the low lead prices discouraged prospecting. It is, however, evident that in this district there are widespread and promising galena ores, which merit much more attention than has yet been paid to them. In Musquodoboit, near the Crawford Settlement, pockets of ore in the granite have yielded lead carrying large amounts of silver.

At Caledonia, small veins of lead ore have received occasional attention. The ore is essentially galena, carrying from 15 to 18 ounces of silver to the ton.

Galena also occurs in considerable amount near Arichat, Richmond county, and on the head waters of the Gold and LaHave Rivers to the west of Halifax. The latter ores carried in some cases as much as 100 ounces of silver to the ton of lead, but, as far as I am aware, no attention has been directed to them. These ores are presumably in the Precarboniferous rocks. On the Salmon River, and near Sydney, in the county of Cape Breton, galena also occurs in limestone, at the former place in considerable amount. Near Burnt and Boulacet Harbours, on the Bras d'Or Lake, are quartz veins carrying galena, copper pyrites, etc. Samples have shown 18½ ounces of gold and 97 ounces of silver to the ton. The adjoining rocks are in places heavily mineralised. On the North and Barrasois Rivers of St. Ann's, in

the county of Victoria, and several other places in that locality, in Precambrian rocks, are veins of quartz and zones of rock showing galena with copper pyrites, blende, etc. A sample of 900 lbs. of ore from McDonald's farm, one mile north of the bridge over the North River, yielded 155 lbs. of lead and 3 oz. of silver.

The most promising deposit of silver lead ore yet found is being developed at L'Abime Brook, Cheticamp, Inverness county, by S. M. Brookfield of Halifax and his associates. The ore occurs as a vein in the Precambrian felsites, etc., and has been traced for several hundred feet, and where opened shows twenty feet of very high grade galena carrying a little copper pyrites.

Mr. Mason, of Halifax, states that from assays made by him and by others, the ore carries an average of one ounce of silver to each unit of lead. Gold also occurs in some assays as high as 14 dwts. per ton, but it does not appear to be a regular constituent.

From his examination of the openings he considers that 50 tons of ore contains 5 tons of galena, and 1,500 lbs. of copper pyrites. This would yield, allowing for loss in dressing and smelting, 3 tons 1,200 lbs. of lead, and 360 ounces of silver, in addition to the copper. The figures, coupled with the accessibility of the mine, etc., etc., and the duty on lead, would indicate very promising results. Other deposits of galena are reported in the same district, but as yet little work has been done on them. Galena ores occur northerly from the Cheticamp River to beyond the McKenzie River, and native silver and carbonate of silver occur in the valley of the latter river and its tributaries. It is probable that the opening of the Cheticamp mine will lead to a careful prospecting of this district, and it is, I feel sure, from information that I have gathered for some years, one of the most promising localities in the province.

From these remarks it will be seen that the lead ores of the province are widely scattered, and have hitherto received little attention. It is very probable that the Lower Carboniferous limestones, which cover a great extent of country, may reasonably be expected to afford workable deposits at favorable points ; for instance, in proximity to intrusive rocks of later date, or wherever they appear to have been in a position favorable to the concentration, aggregation, or deposition of such ores by aqueous agency.

NOVA SCOTIA COPPER ORES.

The remarks I have made about the lead ores of this province apply in a general manner to those of copper. The metal occurs frequently, in the metallic form, in veins and joints in the Triassic trap range running along the south shore of the Bay of Fundy, and in the isolated masses of the same mineral on the opposite side of the Bay. It also occurs in a similar manner in the consolidated ash accompanying the trap, and has been observed in the sandstones of the district, which are referred to the same geological horizon. As yet none of the deposits have, from the superficial tests hitherto made, appeared to be of permanent value. In some localities it is observed disseminated in the rock, and all such occurrences should be carefully tested. It is well known that in the Lake Superior district very small percentages of copper have yielded rich returns to systematic and economical systems of mining and milling. It is true that the two districts differ widely from a geological point of view, but as both yield metallic copper in masses, etc., it does not appear unreasonable to expect that here, as at Lake Superior, it may be found in some localities, scattered in fine grains in the trap, in quantity sufficient to allow of its profitable extraction. Copper also occurs native in the Lochaber district, in Antigonish County, and at Cheticamp, Inverness County.

The carboniferous strata of Cumberland, Pictou, Colchester, Antigonish, and other counties, frequently show outcrops of nests and layers of vitreous sulphuret and green carbonate of copper, sometimes associated with coaly matter. Prospecting has shown these outcrops at Maccan, Wallace River, Pugwash, Tatamagouche, Athol, Oxford, River John, Salmon River, Caribou, Durham and Waugh's River, in the counties of Cumberland, Colchester and Pictou. A few attempts have been made to work these deposits, but the ore although rich is variable and irregular in its occurrence, and work has been abandoned after the extraction of a few tons. A good deal of work has been done during the past two years on some defined beds of sandstone and shale, more or less uniformly impregnated with these and other ores of copper. Among these localities so tested may be named Doherty Creek, River Philip, Malagash Point, Fox Harbor, Gulf Shore, New Annan, Wentworth, and Henderson's Settlement in Cumberland County. The ores are also present at some points in beds of clay resting on cupriferous sandstones, etc. Working samples are reported to have yielded as high as 18 per cent. of copper, with in some cases small amounts of gold and silver. It is understood that the work of testing these deposits will be continued, as the parties interested have so far been much encouraged by the results.

The numerous outcrops of the ores over so wide a tract of country warrant much more attention than has hitherto been paid to them.

At East Dalhousie, in Kings County, there are numerous shows of copper ore, which have hitherto been almost unnoticed. Copper pyrites occurs at Blandford, Lunenburg County, and at several points in Queens and Yarmouth Counties, and is commonly present, in small amount, in the auriferous quartz veins of our gold fields.

The district extending from the head waters of the East River of Pictou, along the county line, to Polson's Lake, in Antigonish County, has yielded numerous indications of the presence of copper ores.

At the head waters of the East River specimens of copper ore occur with a gangue of carbonate of iron, but no attempt has been made to search for their source. In the vicinity of the Garden of Eden, there are veins of spathic iron ore, up to several feet in thickness, holding crystals of copper pyrites.

At Lochaber there are a number of veins carrying copper pyrites, and associated with diorite dykes. These veins have been prospected a little, and are apparently valuable, as the copper contents in the case of the largest vein, about six feet thick, were returned from large average samples at 19 per cent. From this point the cupriferous belt has been traced about four miles to Polson's Lake. Here the presence of large rich boulders instigated desultory prospecting for a number of years. Finally a vein of spathic ore, holding copper pyrites, was found in the year 1875, and traced several hundred feet. Its width, as proved by several shallow pits, varied from 6 to 11 feet. Large average samples yielded from 5.6 to 11.7 per cent. of copper. The distance of this district from a railroad and a shipping point, has apparently postponed its development, although it is probably well worth the cost of a railroad. On the Salmon River, in Guysboro County, some veins were tested a number of years ago, containing copper pyrites and erubescite, and yielding as high as 39 per cent. of copper. The age of the rocks holding these deposits in Pictou, Antigonish and Guysboro counties, is I believe, determined as Devonian, and is in favor of their richness and permanence.

At Ohio, St. Joseph, Brierly Brook, and other points in Antigonish County, deposits of copper ore occur at the junction of carboniferous with older rocks. A little prospecting has shown small veins of rich ore, but as yet enough work has not been done to enable a correct idea to be formed of their extent.

The reports of Mr. Fletcher, of the Canadian Geological Survey, on the Island of Cape Breton, contain frequent references to copper ores. The following places may be mentioned: Benacadie, White Granite Hills, Gillis Brook, Spruce Brook, Irish Cove, East Bay, Washaback, Middle and North Rivers, French Road, Gillis Lake Road, Mira, Cape North, etc.

At Washaback, the ores yielded in addition to the copper, gold up to about one ounce to the ton. At Eagle Head, in Gabarus Bay, Cape Breton County, several shafts have been sunk showing quite large beds, carrying mixtures of copper pyrites with other ores. Those acquainted with the operations consider that the deposits are well worth further examination.

At Cheticamp, Inverness County, there are numerous signs of copper deposits, and occasionally attempts have been made on a small scale to determine their value. This district shows copper ores over so large an extent of ground, that it is probable that this metal will be found present in workable amounts, as well as the lead already referred to. At George's River, near North Sydney, a little prospecting has been done on a very promising outcrop. On the Coxheath Mountains, a few miles to the south, a quite extensive development has shown the presence of several leads carrying copper pyrites, with some silver, from three to twelve feet thick. The copper contents of these beds vary from 3 to 10 per cent, from extraction of large lots. The shafts and levels have yielded several thousands of tons of good ore. Several causes, including financial ones as well as the low prices of copper, have retarded the development of this property ; but as the outlook is now encouraging, arrangements are being made for working it.

In the Island of Cape Breton the copper ores occur in the Precambrian felsites, etc., at Gabarus, Coxheath, George's River, Cheticamp, etc., and are found also in Carboniferous strata.

These brief remarks on the occurrence of copper ores in Nova Scotia will show that they are very wide-spread. They have as yet received almost no systematic examination, and local capital has preferred to venture in better known channels. It may, however be justly claimed that the province presents, in several districts, unusually promising deposits, and that in better known and richer communities, they would before this have supported at least several profitable mines.

IRON ORES.

The iron ores of Nova Scotia are found in almost all its geological horizons. They are of every variety, and in a number of districts are present in large amounts. Practical work has shown their adaptability for the manufacture of iron and steel. At present the extraction of iron ore is confined to the mines of the Nova Scotia Steel Company at Bridgeville, in Pictou county. In view of the presence of large iron and steel works at Sydney, in Cape Breton, the reason for this small output may be presented to explain any surmise as to the non adaptibility of our ores for economic purposes. On Bell island, near St. John's, Newfoundland, there are large

deposits of red hematite, most conveniently situated for working and shipping Owing to a short sea transport, it is claimed that this ore can be laid down at Sydney for less than $1.25 a ton. This deposit is divided between the Nova Scotia Steel Company and the Dominion Iron and Steel Company, and it is found to be cheaper than the local ores, so far acquired by these companies. It will, however, be pointed out that there are localities in the province which will probably on further examination prove capable of competing with the Newfoundland ore.

In the island of Cape Breton iron ores are known to occur at a number of places, but hitherto they have received little attention. At Big Pond, Ben Eoin, Red Island, Loran, Lake Ainslie, Mabou, Cheticamp, Craignish, Loch Lomond and Grand Anse, red hematites are reported. In some cases these deposits are at the junction of Lower Carboniferous strata with older measures. In some cases openings have been made and samples of good quality extracted.

At George's River and Barrasois, on the Little Bras d'Or, in rocks of Lower Silurian and Cambrian age, are red hematites and magnetites. These ores run diagonally across to Escasoni, on West Bay. At Gillis Lake a red hematite from 6 to 12 feet wide was traced by Mr. Moseley for several miles. The magnetites and hematites at Barrasois are reported to be in large quantity, but have as yet not been thoroughly tested as to their quality. Red hematite also occurs at Smith's Brook, East Bay, on a bed said to be 15 feet wide.

On Boularderie Island, at Long Point, spathic ore occurs in a bed several feet wide. In the district lying east of St. Peter's there are several deposits of specular ore up to five feet in thickness, reported to be of fair quality. In the Mira district red hematites from 2 to 6 feet in thickness, have been opened at a number of points, and are of good quality.

The locality which has so far shown the best promise is that extending westwardly from Whycocomagh. Here a number of outcrops of beds from 3 to 12 feet in thickness have been opened. The ore, which is red hematite and magnetite, is of good quality, but the beds have been traced for a limited distance only. As traces of ore are abundant here over a territory 12 by 3 miles, there is every reason to believe that very large deposits are present. This locality permits of cheap mining, is on deep water, and from 3 to 5 miles from the Intercolonial Railway.

The following analyses will serve to show the quality of some of these ores :—

	Loch Lomond.	East Bay.	Whycocomagh	Loran.	Big Pond.	George's River.
Metallic Iron	64.49	57.92	60.90	63.09	61.39	62.50
Silica	7.76	12.80	10.80	5.45	9.04	7.82
Phosphorus	.03	....	trace.	....	trace.	.09
Sulphur	.07	trace.	trace.	.10	trace.	trace.
Phosphoric Acid	....	.16	....	.11	....	....
Alumina	....	1.55	1.40	...	....	....
Magnesia	....	.60	1.64	4.20	1.22	.88
Lime	....	1.20	1.85			
Water	....	1.30	....	....	1.53	.67
Manganese	2.85	.26	....	....	....	1.10

Passing to Nova Scotia proper, the first deposits met are those of Guysboro County. A large tract of Devonian strata between Milford Haven and Salmon River contains specular ore at numerous points. At Erinville two large bodies of ore were tested some years ago. They were 12 and 65 feet wide. No doubt other large deposits will be found by systematic prospecting. These ores occur on tide water, and at distances therefrom up to 12 miles. These ores are fairly compact, mining from 55 to 62 per cent. metallic iron, and are low in sulphur and phosphorus. The Nova Scotia Steel, and the Dominion Iron and Steel Companies have acquired large tracts in this district. Similar ores, of good quality, occur in Boyleston and Manchester townships, but the veins hitherto opened are small.

At Arisaig and Doctor's Brook, in Antigonish County, there are numerous bedded deposits of red hematites in Silurian strata. These beds, which are receiving some attention, are from 3 to 20 feet in thickness and are reported in many cases to run 60 per cent. in iron, and to be low in phosphorus. There is no doubt that there are large quantities of ore in this district, and it is anticipated that exploratory work will prove the deposits to be uniform in quality and unbroken in extent. They are close to water and about 8 miles from the Intercolonial railway.

Signs of the passage of these ores are found until at a distance of 25 miles a point is reached on the East River of Pictou where explorations have shown the presence of large deposits. Here, in a district 8 by 12 miles, 4 beds from 5 to 30 feet in thickness have been proved to underlie large tracts of country. At the junction of these measures with Lower Carboniferous strata, from Springville to Sunnybrae, there are numerous deposits of brown hematite. They have been worked for a number of years by the Nova Scotia Steel Company for mixture with their Newfoundland and Torbrook red hematites. The production last year for this purpose was about 16,000 tons. This company has an 80 ton furnace and washing and retort oven plant on the East River, near Hopewell.

On the West side of the East River (East Branch) there are extensive signs of the presence of brown hematite deposits, and a vein of specular ore has been traced several miles. In places it yields 15 feet of ore. Still further west on a tributary of the West Branch the presence of brown hematite ore is marked by numerous deposits of drift ore. Spathic ore occurs on McLellan's Brook and Sutherland's River, and at the latter place some exploratory work showed a bed 6 to 10 feet thick. Still further east on French River there are a number of beds of a nodular red hematite varying in thickness up to 5 feet. This district contains very large amounts of ore, favorably situated for working, and near the Pictou coal field with which it is connected by a branch railway running from Sunny Brae to the Intercolonial Railway at Ferrona.

The following analyses will serve to show the quality of some of these ores:

	Specular.	Brown hematite.	Red hematite.
Manganese oxide	2 16	.20	....
Alumina	.21	....	....
Lime carbonate	1.27	.63	3.03
Magnesia "	.43	....	....
Phosphoric acid	.08	.15	.20
Sulphur	.16	trace	....
Silica	3.68	4.26	25.82
Metallic iron	64.41	56.83	45.47

SPATHIC ORE.

Sesquioxide of iron	20.52	....
Carbonate of iron	57.40	82.11
" manganese	8.29	4.70
" lime	4.02	2.37
" magnesia	5.66	9.06
Silica	2.38	1.69
Moisture	1.43	....
Sulphur	none.	.10
Phosphorus	none.	none.
Metallic iron	42.07	39.64

Small beds of clay ironstone occur in the Pictou coal field, and in the district north of New Glasgow.

Deposits of iron ore are known on the upper waters of the Stewiacke River, at Newton Mills, Grand Lake, Goshen, Clifton, Selma, Brookfield, Mount Tom, Kemptville and North River. Those at Brookfield and Selma have been worked to a small extent.

In the Londonderry district, in Colchester county, there is a band of slates carrying bodies of brown hematite included in a stratum vein of carbonates of iron, lime and magnesia. These were worked for a number of years to supply a charcoal furnace, and two coke furnaces. During the last depression in the iron trade the furnaces were closed, and have since remained idle. The deposits extend for a number of miles, and are available for large supplies of a high grade brown hematite. Near Pugwash, in Cumberland County, similar ores are said to occur in quantity. The trap rocks, of Triassic age, extending along the south side of the Bay of Fundy, contain numerous veins of magnetite and red hematite, not, however, yet observed of workable size.

The Devonian or Upper Silurian measures of the Annapolis Valley extend in a narrow band from Digby to a point a few miles west of Windsor, with several interruptions due to granitic masses. At Clementsport two beds of ore, from 2 to 6 feet thick, have been noticed. In the Nictaux and Torbrook

districts a large number of beds of red hematite and magnetite have been observed over a district 10 by 4 miles, and are from 2 to 20 feet in thickness. As yet enough work has not been done to permit of their correllation, but the general structure of the district appears to be that of two synclinal folds repeating the beds. These deposits have been traced in a continuous line from Black River to Nictaux, a distance of six miles, and have been proved by shafts and boreholes to maintain their quality and size to a depth of 400 feet. Their contents run from 52 to 62 per cent. of iron, are low in sulphur, and vary in phosphorus from ·03 to 1·30. There are in this district enormous amounts of ore, easily extracted, intersected by railways, and about 32 miles from shipping at Annapolis via the Dominion Atlantic railway. The Torbrook Iron Company worked for several years, with an annual output of 30,000 tons, on a red hematite bed 6 to 10 feet thick, until the Londonderry furnaces were closed, and the Nova Scotia Steel Company drew its supplies from Newfoundland.

From these notes it may be inferred that the iron ore resources of Nova Scotia are very considerable, and compare favorably with any deposits, except a few of international celebrity. The Torbrook, Nictaux, Londonderry, Pictou, Antigonish, Guysboro, Barrasois and Whyhogomah districts undoubtedly contain large amounts of ore, and the indications in other districts warrant attention.

There can be no doubt that as the expense attending the working of the deposits at present supplying high grade ores to the manufacturing districts of Europe increases, the ores of this province will receive greater attention. It may be said that at this date they could, in conjunction with our excellent fuels, maintain several establishments capable of producing pig iron at rates cheaper than those now obtaining in Europe.

MISCELLANEOUS MINERALS.

Gypsum.—This mineral may be considered specially characteristic of Nova Scotia, as deposits of equal extent and variety are met at no other point known to the writer. It occurs as soft or hydrated gypsum, having the following typical composition :—

Lime	32.55
Sulphuric acid	46.51
Water	20.94
	100.00

and as hard or anhydric gypsum, containing 41 per cent. of lime and 55 per cent. of acid. It is usually massive or granular, but occurs as selenite, in tabular crystals, and in segregated crystals, and as fibrous gypsum.

The exposures show beds from a few inches up to 100 feet in thickness, and it is often found in grains, veins, and crystals in the associated shales, marls, and limestones. In this province it occurs in the lower carboniferous limestone formation. As these measures occur in Halifax, Hants, Kings, Cumberland, Colchester, Pictou, and Antigonish counties, and in all the counties of Cape Breton, it would be impossible to give all the localities. The amount available in the province is inexhaustible. As might be expected it is not everywhere of the best grade, but every district contains deposits available for agricultural purposes, and in many localities there are abundant deposits of the best quality. The chief localities where it is worked are Windsor, Cheverie, Maitland, Walton, Hantsport, Wallace, Antigonish, Mabou, Judique, Port Hood, Port Hawkesbury, Lennox Passage, St. Ann's, and Big Harbor, near Baddeck.

Among the minerals found in the gypsum may be mentioned : glauber and common salt, calcspar, magnesite, arragonite, carbonate and oxide of iron, silica, and free sulphur. In the Windsor district, considerable amounts of boro silicate lime compounds have been noticed. Among them is ulexite, a very pure form of the Peruvian "tiza." These minerals can be utilized in glazing operations, and would be of value if found in quantity. I give an analysis of natroboro calcite (ulexite), as found at Windsor :—

Water	34.29
Lime	14.20
Boracic acid	44.10
Soda	14.20

The hard gypsum frequently occurs in lenticular masses imbedded in the soft gypsum, and as beds underlying, and alternating with it. The attention of the quarrymen however is directed to the softer variety. Gypsum has been largely exported to the United States from the Windsor district, and smaller shipments have been made from Cape Breton It is shipped as rock, and not prepared in any way, owing to the duty being virtually prohibitive on any manufactured form. It was at one time used as a top dressing for cotton crops, but now finds its principal use, in the States, for architectural purposes, and in the manufacture of fertilizers.

The transparent crystalline selenite commands a higher price than the ordinary gypsum, and is utilized as a filler for paper. Small lots are occasionally shipped, but as yet it has not been observed in amounts permitting of regular production.

SHIPMENTS OF GYPSUM FROM NOVA SCOTIA FROM 1890 TO 1901.

Year.	*Tons.*
1890	146,003
1891	161,934
1892	162,285
1893	98,247*
1894	106,171
1895	133,300
1896	130,489
1897	125,000
1898	131,000
1899	140,000
1900	122,281

*Nine months only.

The gypsum marketed in this province is in the manufactured form of "Land Plaster" and Plaster of Paris. The crude gypsum is exported to the United States, being quarried and delivered on board ship for about $1.00 or a little less per ton.

Inferior grades of gypsum are ground and sold as a fertilizer, being called "Land Plaster." It is used in the province as a fertilizer, either alone or in combination with other ingredients. The superabundance of commercial fertilizers now in the market, however, cannot but limit the sale of any one kind. The ease with which crude gypsum can be obtained in some of our agricultural districts also perhaps makes the necessity of a manufactured article less felt. This ground gypsum, or "Land Plaster," is also being used as an absorbent in stables and poultry houses, and is beginning to be employed for the same purpose in slaughter houses. The Windsor Plaster Co's. "Land Plaster" sells at present for about 90 cents per bbl. in carload lots at Halifax.

Plaster of Paris, or Calcined Plaster, is also extensively manufactured at Windsor by the Windsor Plaster Co., and is sold throughout the province to a large extent, bringing at present about $1.25 per bbl. in carload lots at Halifax. It is largely used in giving a "hard finish" to walls and ceilings, making cornices, etc. By more careful manufacture and finer bolting, Plaster of Paris of the very finest grade could be manufactured in the province, whereas at present the most superior grade is usually brought from the United States, where it has been largely manufactured from our own gypsum. In the local market the Windsor Plaster of Paris enters largely into competition with that of Hillsboro, N. B.

What is probably a coarser grade of Plaster of Paris, with possibly other ingredients, is gaining a market here under the trade name of "English Selenite Cement," and is used in plastering walls as "hard finish," the advantage over ordinary plaster being that it sets very quickly and is very hard. Its wholesale price at present at Halifax is about $1.30 per bbl.

Manganese.—The exceptional purity of some of the manganese ores found in Nova Scotia makes them interesting to the mineralogist, and valuable in certain operations of the manufacturer. The attention paid to these ores is by no means proportionate to their value, and to the great extent of the geological formation to which they appear to be chiefly confined.

The least valuable, but the most common of these ores is wad or bog manganese. It is found as a superficial deposit in connection with every geological formation known in the province. Among the localities yielding it may be mentioned Jeddore, Ship Harbor, St. Margaret's Bay, Shelburne, La Have, Chester, Parrsboro, Springhill, and several localities in the counties of Pictou and Antigonish. On Boularderie Island, Cape Breton County, it occurs as a bed several feet thick, containing from 25 to 44 per cent. of manganese per oxide, from 12 to 35 per cent. of sesquioxide of iron, and from 10 to 33 per cent. of insoluble matter. At Londonderry, in the iron mines, in precarboniferous strata, the ores have, in places, been enriched by manganese oxide to the extent of 14 per cent.

Pyrolusite occurs near Mount Uniacke in pockets and veins penetrating granite, and in the quartzites of the auriferous rocks. It also occurs as veinlets in granite at Musquodoboit and Ship Harbor. In the slates of Devonian age, south of Wolfville, it is found in small masses and stringers.

Pyrolusite and its associated ores occur however most conspicuously in the lower horizons of the Carboniferous and in some of the upper divisions of the Devonian. In the northern part of Hants County a manganiferous limestone belt appears to pass from the mouth of the Shubenacadie River to Tenny Cape, and to Walton and Cheverie. This appears to underlie the gypsiferous strata. The measures carrying manganese ores reappear again south of Windsor, and at Douglas, fifteen miles south of Tenny Cape, and

near the line of junction with the gold bearing rocks. In this range of measures the manganese of Tenny Cape appears to be principally connected with a red and gray limestone, dolomitic in composition. At the western end of the district it occurs as veins in conglomerates and sandstones, and also in limestones in places magnesian.

The Tenny Cape ore occurs in irregular nests and in seams erroded on the bedding planes and cross fractures. The ore is chiefly a fibrous pyrolusite, with splendent lustre, based on a compact or granular ore consisting of pyrolusite, of psilomelane, and of manganite, the latter not present in large quantity. The quality of these ores is very high, judging from the fact that many tons have been shipped yielding from 88 to 95 per cent. of available oxide.

The following analyses show the general character of these ores :—

	Douglas.	Cheverie.
Moisture	1.660	2.05
Water of composition	3.630	....
Iron peroxide	.603	2.55
Oxygen	7.035	....
Baryta	.724	1.12
Insoluble	1.728	2.80
Phosphoric acid	....	1.020
Manganese oxides	84.620	....
Peroxide of manganese	....	90.15
Lime	....	trace.
	100.000	99.699

At Walton and Cheverie manganite is more common ; its composition may be shown by the following analyses :—

	Tenny Cape.	Cheverie.
Manganese oxides	85 54	86.81
Iron peroxide	1.18	2.05
Baryta	.89	
Insoluble matter	1.27	1.14
Phosphoric acid	.34	....
Water	8.54	10.00
Available oxygen	51.54	17.73

Calcite, red and brown hematite, barite, and selenite occur with the ores of this district.

Minudie, in Cumberland County, has yielded small quantities of soft fine-grained pyrolusite giving 97.04 per cent. of binoxide of manganese. Similar ores are found at Onslow, and on the Salmon River, near Truro. Boulders containing a mixture of psilomelane and manganite are found associated with brown hematites at the Bridgeville iron mines, and in places the ore is heavily charged with manganese.

In Antigonish County similar manganiferous iron ores are found in the drift at several places.

In Cape Breton County, at Salmon River, several shipments of manganese ore have been made from the Moseley mines. The deposits occur as beds and irregular layers and nodules in soft arenaceous shale, and associated with a dark manganiferous limestone, both of lower carboniferous age. The ore is generally a soft fine-grained or subcrystalline pyrolusite, sometimes containing manganite. The ores run as high as 88.9 per cent. of binoxide, and are very low in iron.

During the past two years a few shipments of ore have been made from the college grant, New Ross, Lunenburg county. The ores extend over a large tract of country and are said to occur as veins sometimes three feet in thickness. The distance of the district from shipping has proved a drawback to mining. The ore is apparently a mixture of psilomelane and manganite, and is said to carry up to 50 per cent. of manganese with traces of phosphorus, and to be suitable for ferromanganese.

The shipments of these ores have never risen to a large figure, and for many years have ranged from 50 to 500 tons, principally from Tenny Cape, with small lots from Walton, Cheverie, Truro, New Ross, and Cape Breton County.

There are no doubt localities in which these widely spread ores will be found in considerable amounts, but as yet the indications have received little attention. The demand for the rich Tenny Cape ores seems to have fallen off, presumably owing to the introduction of methods permitting the utilization of cheaper sources of the oxide. There is, however, a large demand for manganese ore and manganiferous iron ore, suitable for steel-making processes, and a search would probably, owing to the presence of the purer deposits, reveal the existence of the less highly manganiferous bodies adapted for the use of the iron and steel maker.

Antimony.—The sulphide of this ore occurs at Rawdon, in Hants county. A mine was worked here for some years and about 3,000 tons shipped. Owing to the distance the ore had to be hauled to reach the railway, it was found profitable to ship only the richest, and a fall in prices caused the closing of the mine. A few years ago properties were acquired here by Mr. A. McNeil and others, and a number of veins were found in the vicinity of the one originally worked. The ore carries considerable quantities of gold, and the opening of the Truro-Windsor railway will assist in the development of this district, which is undoubtedly of importance.

The following assays were made for the Department by Mason and Asquith of samples from the veins recently opened :—

	No. 1.	No. 2.
Antimony	45.75%	18.21
*Gold	2.48 oz. per ton.	.23 oz. per ton.
*Silver	.10 " "	.13 " "

*Ton of 2,000 lbs.

N. B.—No. 1 samples were taken from the pay streak, and were a fair average. No. 2 were from the large bodies of low grade ore.

Celestine.—This mineral, the Sulphate of Strontium, is reported by Mr. H. Fletcher as occurring on the right bank of the Sydney River, about a mile and a half above the bridge, in a bed about a foot in thickness.

Sulphur.—Common and magnetic iron pyrites are found in many places in the province. It is reported as occurring in Queens and Shelburne Counties in masses and aggregations of crystals. A considerable body of rather low grade pyrites is known at the head water of the George's River, Cape Breton County. It is found near Salt Springs, Pictou County, cementing a coarse sandstone, but has not yet been found in the province in quantity permitting of its utilisation for acid making. It is reported as occurring in gypsum, near Brookfield.

Molybdenum.—The sulphide of this metal is found at several points, as at Gabarus and Louisburg in Cape Breton, where it occurs in small quantities over a large district. Hammonds Plains, Bedford, Lower Musquodoboit, New Germany, and New Ross have yielded specimens, those from the latter locality being frequently in large and handsome crystals.

Cobalt and Nickel.—These metals are not uncommon in the province, but hitherto have been observed only in traces. It occurs in mispickel at Montagu and Cochran's Hill, in copper pyrites at Caribou, Pictou Co., and at Londonderry.

It has been reported in magnesia alum from Newport, and in magnetic iron pyrites from Nictaux and Geyser's Hill. Cobalt is noticed also in bog manganese.

Zinc.—The sulphite, zinc blende, is frequently found in auriferous quartz veins. It also occurs with galena at Cheticamp, Inverness Co., where development work is being done on deposits of considerable size, which carry valuable amounts of silver and lead. Samples of similar ores are reported from the district extending along that shore for fifteen miles north of Cheticamp.

Tin.—Tinstone is reported as occurring at Tangier, Shelburne and Country Harbor, associated with granitic debris.

Arsenic.—Arsenical iron pyrites is abundant in the auriferous quartz veins.

Phosphates.—Mr. Fletcher (Geological Survey Report, 1876-77, p. 453,) mentions the occurrence in the Lower Silurian limestones of MacIntosh Brook, Cape Breton, of layers of phosphatic nodules. Similar deposits have been observed at Arisaig, and in Colchester county samples are said to have yielded as high as 40% of phosphate of lime. The blue phosphate has been observed near the town of Antigonish. It is doubtful if any of these deposits are of economic value. Discoveries of apatite similar to that extensively worked some years ago in the province of Quebec, may be anticipated in the Precambrian limestones, etc., of several parts of Cape Breton.

Salt.—This mineral is found in crystals in many of the gypsum quarries, and occurs abundantly as brine at numerous points in the lower carboniferous measures. The apparent similarity of the conditions attending the accumulation of the gypseous series in parts of Nova Scotia and in Europe leads to a hope that beds of salt may be found here by means of boreholes. This subject is one of considerable importance, but has not yet received serious attention in Nova Scotia.

In this province salt has been made at various times from brine springs, and in some cases a superior article was produced. At present there is no attempt being made to utilize them. Among the various springs may be mentioned those of Renfrew, Walton, Salt Springs, Irish Mountain, Sutherland's River, Antigonish, Ohio, Baddeck, Whyhogomah, River Philip and Black Brook.

The following analyses will show the character of some of these brines :—

	Walton.	West River.	Little Narrows.
Lime carbonate	14.73	3.775	....
Magnesia "	trace.	2.932	....
Iron "	....	....	....
Phosphoric acid	....	....	....
Magnesium chloride	4.48	27.330	.1593
Lime sulphate	161.16	154.730	5.6810
Common salt	787.11	4133.500	50.6881
Silica	....	.560	trace.
Calcium chloride	....	51.910	.1942
Total	967.48	4374.737	56.7226
Salt per cent	1.1	5.9	

The analyses of Walton and West River brines give the contents in grains to the imperial gallon ; that of Little Narrows gives the solid contents in 1000.00 parts.

Building Stones.—The stone used for structural purposes in this province is either sandstone or granite. There are several varieties of the former, passing from a very light fawn to a purplish red. The granite used is of a

standard gray colour. As the sandstones and freestones fit for the quarryman's work occur chiefly in the Upper Coal measures and the Permocarboniferous, we find the principal quarries extending along the straits of Northumberland from Merigomish, in Pictou County, to the Joggins, in Cumberland County. The quarries are in most cases conveniently situated for either railway or water transport, and for effective quarry work.

Samples of these stones were forwarded to the Paris and Glasgow exhibitions, and the following notes from a paper on the Nova Scotia minerals for the Paris exhibitions, read before the Nova Scotia Institute, session 1899-1900, will serve to show their position and extent.

QUARRIES.

These notes refer to the quarries in the northern part of Cumberland County, which furnished samples of their products.

Quarries at River John.—No. 1. This is the only quarry at present working in this district. It is situated at River John and about a quarter of a mile from I. C. Railway, and is connected therewith by a good road.

It contains a reddish sandstone of fine grain, and has been opened for about 350 feet in length, exposing a face so far of about 14 feet. Stones are cut here up to about 33 cubic feet, though almost any size could be obtained with larger machinery. The seams are very regular in formation and lie nearly horizontal. Worked for nearly a year.

No. 2 adjoins the first quarry, and resembles it in general characteristics, though the stone is of a lighter colour.

No. 3, about a quarter of a mile up the river from No. 1, was worked for six years intermittently. Many grindstones were cut in this quarry, which yields a firm grey sandstone.

Wallace Harbor.—The Wallace Gray Stone Co., Wallace Harbor, John Stevenson, manager. This quarry is situated at Wallace, and a great part of the stone is shipped by water, though it is connected with the I. C. Railway by a good waggon road about two miles long.

Though the stone is carried to the wharf by horses, a tramway (gravity) could easily be operated, the quarry being situated on a hill. The distance is about a quarter of a mile. This quarry has been worked for a period of nearly thirty years off and on, and is still only partially developed. It produces an average of about 1,500 tons ("quarry") a year, of fine grained sandstone in two colours—"olive" and "bluish."

Blocks up to ten tons in weight and measuring fourteen feet are cut, and the greater part of the stone is shipped to the Boston and New York markets. The poorer stone is sold locally.

Wallace Harbor.—The G. P. Sherwood Co., T. C. Dobson, manager. This quarry adjoins the quarry of the Wallace Gray Stone Co., and the same remarks apply to it.

At Wallace Bridge the famous Battye Quarry is being operated by George Battye. Stone has been taken from this quarry since the year 1809, and there is still much in sight. It is situated on the I. C. Railway and the Wallace River. Chief market New York and Eastern States cities. Blocks up to ten tons are cut. At present 25 feet of rock is shown in the face, with seams measuring from 2 to 6 feet in thickness. This is composed of a very uniform and beautiful sandstone, suitable for monuments as well as construction work.

On the River Philip, about five miles from Pugwash, is situated the quarry of McLeod & Embree. It produces a handsome red sandstone contained in seams from 2 to 7 feet, and shows altogether 20 feet in the face. Blocks cut to 8 tons. Has been operated for upwards of 30 years, and usually ships to the States. This year all the stone quarried is being supplied to Toronto.

The Atlantic Stone Co., Limited, R. S. Hibbard, Manager.—The quarry of this company is situated on Cumberland Basin, $3\frac{1}{2}$ miles from Joggins Station, on the Canada Coal Company's Railway, and 16 miles from I. C. Railway. The stone is shipped chiefly by water, in vessels up to about 300 tons. The market is mainly in the New England States, though the stones are occasionally sent much further west. 2,000 tons shipped per year. This quarry produces a very superior form of grindstone. Stones from half an inch to 14 inches thick, and up to 7 feet in diameter are cut, though almost any size that could be handled is procurable.

At Lime Rock, West River, Pictou Co., are sandstone quarries yielding good building stone. Samples are shown by Mr. J. H. Fraser. In the Merrigomish district the strata lying above the Productive measures yield grindstones and fair qualities of freestone.

Other localities are Pictou, and Glenfallock. On the Basin of Minas, Cornwallis, Johnston Brook, Horton, Falmouth, Kennetcook, Nine Mile River, and Old Barns, have yielded freestones in some cases of delicate shades and good texture. In Cape Breton sandstones from the Millstone grit and the Coal measures have been used to a limited extent for building purposes.

Syenites, Porphyries and Granites.—Granite is very abundant among the older rocks of the Province. Among localities which have furnished it for building purposes, may be mentioned Shelburne, Queens and Lunenburg Counties. It also occurs at Aspotogan and various points thence to Halifax. As already mentioned, in describing the Gold fields, it runs continuously from Halifax to Windsor, and thence westward. It occurs again at Waverley, and runs through Musquodoboit, Jeddore, Ship Harbor, Sherbrooke, and Country Harbor to Canso. It occurs inland at the head waters of many of the Eastern rivers, and is estimated to cover a large area of the Atlantic coast

district. It has however, been quarried only at points accessible to shipping At Halifax, it has been used a good deal about the fortifications, and a number of houses have been constructed of it, its cost, rough, being from $2.25 to $4.00 a ton.

In the Cobequids, there are masses of flesh and red colored syenite, which have afforded very handsome polished samples ; but as yet have not been worked for construction. Porphyries and syenites occur in various parts of Cape Breton, but their economic value has not been tested. The following localities may be mentioned,—St. Ann's, Boisdale and Coxheath. The crystalline diorites of Louisburg were used by the French in building their fortifications.

Limestones.—This material has not been used to any extent in Nova Scotia, for building purposes, although it is frequently found to stand exposure well, and to be readily quarried. Among localities yielding it, may be mentioned the Shubenacadie River, Kennetcook, Lower Horton, Thompson Station ; Glengarry and Springville, Pictou County. Stones from a quarry here, retain, after an exposure of sixty years, every trace of the chisel or pick. The marbles will be noticed further on.

As before mentioned the anhydric or hard gypsum has been used to a small extent for walls, foundations, etc. A flaggy arenaceous schist, known as iron stone, was extensively used some years ago, for warehouses and walls in Halifax. Many of the metamorphic sandstones of the Atlantic coast would furnish a most pleasing and durable building material.

At present the supply of wood for building purposes is so plentiful, that brick or stone houses are the exception. Even public buildings, churches, halls, etc., are almost always of wood ; but as this material becomes more expensive, the labor of the quarrymen will succeed that of the lumbermen, and our towns become something better than wooded shells blackened by smoke.

Flags and Slates.—A small amount of flagstone has been quarried on the North-West Arm of Halifax Harbor, and at Beaver Bank. Slates were quarried to a small extent at Rawdon, and various places in Hants County, and the quality and quantity are equal to any demand. Dalhousie Mountain and West River, Pictou, are said to have good slate beds, and it is also reported from the South Mountain, in Digby and Yarmouth Counties.

At the Provincial Exhibition of 1879, slates were shown from Sackville, River John and Upper Stewiacke, which, although in the rough, were of good material.

The demand for roofing slates will become general in the province in a few years, as their superiority over the shingles in ordinary use becomes apparent.

Brick Clay.—These clays are found in many places, presenting an unlimited supply of raw material for the brick maker. As yet, brick is but little used in the province, although when well made and used according to proper designs, it makes the best building material for this climate. The best known clay fields are those of Shubenacadie, along the line of the Intercolonial Railway, and many points in the carboniferous districts of Colchester, Pictou, Cumberland and Antigonish.

Limestone.—In Nova Scotia the limestones are confined practically to the Lower Carboniferous, and are generally associated with the gypsums. There are also beds of this material, sometimes metamorphosed into marble, in the Laurentian, etc., of Cape Breton, and in the Cambrian and Silurian measures, but they do not usually form deposits of economic value in the latter measures. The carboniferous limestones are strongly developed in Cumberland, Colchester, Hants, Kings, Pictou and Antigonish Counties, and at many points in Cape Breton. They occur in beds varying in thickness from a few inches to 50 feet, and in some localities their aggregate dimensions will exceed 400 feet. Their quality varies from calcareous sandstones and clays to the crystalline pure mineral.

At Windsor, Brookfield and many other localities beds are found composed entirely of fossils characterising the Marine Limestone formation, and give the following component parts on analysis by Dr. How :—

Carbonate of lime	97.64
" magnesia	1.10
Oxide of iron	.07
Phosphoric acid	trace.
Insoluble residue	.68

A limestone similar to the above was extensively quarried at Brookfield as a flux for the Londonderry iron ores.

The limestones of Pictou County are also well adapted for fluxes. The following analyses of a limestone from Lime Brook, Springville, were made for the Halifax Company at the Durham College of Physical Science :—

	I.	II.
Lime carbonate	93.90	96.26
Magnesia "	2.45	2.33
Iron peroxide	.59	.57
Manganese peroxide	.56	.55
Alumina	.12	.10
Sulphur	.03	.02
Phosphoric acid	.03	.03
Silica	2.10	1.99
Moisture	.18	.17

These results are confirmed by an extensive series of analyses made some years ago by the writer, embracing all the more important exposures of that

mineral in the vicinity of the Pictou coal and iron deposits, but the space at my disposal would forbid its insertion. The position of the East River limestones forms an important item in their adaptability for fluxing purposes. They occur as a band everywhere between the coal and iron, so that their transport becomes a matter of comparatively low cost, and large quantities are available by simple quarry work. A quarry at Black Rock, above Bridgeville on the East Branch, has furnished flux for many years to the Ferrona furnace.

Some limestones at Horton, Onslow, the Joggins, Pugwash and other places are bituminous, and contain notable quantities of phosphoric acid. As already mentioned, some of the East River limestones contain important percentages of carbonate of iron, and may, at some localities, afford an ore of this metal, in addition to the spathic ores referred to before.

In Cape Breton, several places are known which afford marble believed to be well adapted for building and decorative purposes. The finest deposit of workable limestone yet discovered is on West Bay, Bras d'Or Lake. In variety of color and tint this rock resembles the limestones of the George River series, of which it forms a part, but it contains little or no admixture of foreign materials, and is uniform to texture and in unequalled abundance. The following varieties have been recognized :—

1. Fine white statuary marble.
2. Fine white building "
3. Coarse white building "
4. Blue and white clouded marble.
5. Brocatello marble, mixed with six varieties of colored marbles.
6. Fine flesh-colored marbles, often striped and variegated.

The locality offers every facility for quarrying and shipping, and blocks of any required dimensions can be shipped cheaply to the United States, equal in quality to those already admired as samples. These marbles are in many cases magnesian. At present large quantities of lime are burned here, and the Dominion Steel Company have extensive openings furnishing the flux for their furnaces at Sydney. The same company has also drawn largely upon the marble of George's River, in Cape Breton County, as a flux and for use in the concrete foundations of its furnaces, ovens, etc.

At St. Ann's Mountain, Cape Dauphin, Salmon Creek, Whyhogomah, River Dennis, George's River, French Valley and Escasoni, marbles are also found. At the latter place they are usually too much broken and mixed with other rock to be available for artistic purposes.

A magnesian limestone on the property of the Messrs. Burchell, at Kelly's Cove, Victoria County, has been extensively quarried by the Nova Scotia Steel Co. for linings for convertors, etc.

At Five Islands, Colchester County, promising marble deposits are known.

The carboniferous and other limestones are quarried at all points for lime for building and agricultural purposes. That from East Bay has been extensively burned for lime. The Nova Scotia lime is frequently brown, arising probably from carelessness in selecting and burning; its price per barrel may be averaged at 95 cents. At numerous points in the province the limestones contain foreign ingredients, indicating the presence of a certain amount of hydraulicity, such as alumina, carbonate of iron, magnesia, silica, etc.

The well-known Portland cement was invented in accordance with the desire for a material which would set rapidly, and remain indurated in water. Lime, itself, is useless for this purpose, unless mixed with the proper proportions of an argillaceous compound. Many good natural cements have been used at various times, but the want of uniformity in the composition of the calcareo argillaceous rocks they were made from soon rendered their action even dangerous.

In this province, although many limestones possess hydraulic qualities, their uniformity cannot be relied on. Hence, our cements, which are natural ones, have never proved permanently satisfactory. The limestones and clays of the province will answer for the manufacture of cement; but the absence of chalk requires more care in the manipulation of the limestone, and a consequently increased cost.

At present I am not aware of any Nova Scotia cement in the market, the Portland cement being generally called for in contracts and specifications. Among Nova Scotia limestones possessing hydraulicity may be mentioned those from Horton, Windsor, St. Peter's, Chester, Onslow, Shubenacadie, Springhill, Whyhogomah, etc. In the lockwork of St. Peter's Canal, Portland cement alone was used.

The quantity burnt for agricultural purposes must be very considerable; but no returns are made of the amount thus used, and in many parts of the province nature has supplied this fertilizer in abundance. The Mines Department gives the amount of limestones and ankerite quarried during the year 1900 at 50,000 tons, but this refers only to that used for smelting purposes, and does not include the amount extracted by individuals throughout the province.

Paints.—Mineral paints as found in Nova Scotia may be divided into two classes. The first consists essentially of iron ores, composed of hydrated peroxide of iron, with manganese, silica, alumina, and water of hydration. They are frequently, as far as their composition goes, suitable for smelting, having been originally carbonates of iron, lime, and magnesia, and having had the lime, phosphates, sulphur compounds, etc., leached out. But their friability and excess of moisture would require their manufacture into briquettes before being smelted. Good examples of these ores are met at

the Londonderry mines, where they appear to have been formed from the ankerite and sideroplesite forming the vein stone.

The following analyses show the original and present composition of these minerals:—

COMPOSITIONS.	ANKERITE.		OCHRE.	
	Yellow.	Brown.	Yellow.	Red.
Iron-Carbonate	23 45	20.30	Peroxide. 74.52	70.20
Lime Carbonate	43.80	49.20	Oxide. .40	5.50
Magnesia Carbonate	30.80	50.20		2.80
Manganese Carbonate	.80	....	Oxide.	.45
Silica	.10	....	6.20	14.40
Alumina	....	....	4.80	6.80
Water	....	....	14.40	....

The red colours produced by burning the ochres are modified to purples by manganese, and to browns and grays by mixtures of white aluminous clays and other impurities. Similar ochres occur in Antigonish and Pictou Counties, in connection with the specular ore veins, and at Chester and numerous other points. At Chester the ochres are produced by the oxidation of Lower Carboniferous limestones containing manganese, affording purplish paints which were formerly manufactured to some extent.

The other class of ochres appear to have been formed by water depositing in beds of earth, marl, etc., the oxides of iron, manganese, etc. Such deposits occur at Folly Mountain, Onslow, Kentville, Cornwallis, Polson's Lake, Chezetcook, Lunenburg, and in Cape Breton. Small quantities of these ores have been treated at several points for local use. These deposits pass into bog iron ore or wad manganese, as the conditions of disposition permitted.

These mineral paints occur abundantly in Europe, and their price is too low to permit of the utilization of the local deposits for the limited home market or for export. The price of the continental ochres and umbers depends not only on the original ore, but also on the care with which they are cleaned and manufactured.

Barytes.—This mineral is frequently met in the province, and a small annual production has been maintained for a number of years. It is confined to no particular geological horizon, but is met in the Carboniferous and all the older formations. It is principally used in the manufacture of paints and enamels. Its value depends largely on its freedom from iron, copper and other ores. It is found in irregular pockets in Lower Carboniferous at Five Islands, Colchester County, usually in characteristic tabular crystals, with calcspar and copper pyrites. It has been mined at River John, and at Brookfield and Stewiacke. It occurs with limonite at the mouth of the Shubenacadie River, at Clifton. Among other localities may be mentioned the Lower Carboniferous of the Avon, Musquodoboit and

Wallace Rivers, and at Greenville, Cumberland County. It is frequently found with the manganese ores of Hants and Colchester counties. In Cape Breton it was mined for several years at Lake Ainslie, and at present an annual output of 783 tons is secured from Cape Rouge, Inverness County. Other localities reported in Cape Breton are Whyhogomah, Cheticamp, Loch Lomond, St. Annes and East Bay.

Fire Clays.—Clays are essentially hydrated silicates oi alumina, also holding moisture. Their plasticity when mixed with water depends on the presence of the water of composition, and when heated to redress, it is driven off, and they lose this property. When these clays stand a high temperature without melting or softening, they are termed refractory or fire-clays. They occur in various geological formations, those of the best quality being generally obtained from the coal measures, where they usually form the beds underlying the coal seams.

The mechanical mixtures accompanying clays are silica, carbonates of lime and magnesia, pyrites, etc. They affect the heated clay in various ways, by causing unequal expansion and cracking, and by forming fusible slags. These effects depend not only on the amounts of the impurities, but also on their relative proportions, as in the case of furnace slags. Among the purer clays are those holding large proportions of pure silicious sand, such as the celebrated Dinas brick clay.

Fire bricks are required to stand in some cases, high and prolonged heat, alternations of temperature, not to soften when heated, or run when in the presence of heated metallic oxides. Any one clay will seldom meet all of the above requirements, and various materials are added to counteract the failing, such as sand, powdered millstone grit, clay previously burned and ground, etc.

The method of making fire brick resembles that followed in the manufacture of common brick. The clay, after weathering, is carefully ground, etc., and burned for five or six days in kilns of 15 to 20 thousand.

The following analyses will show the composition of several Nova Scotia fire clays :—

	Lingan.	Deep Seam.	Springhill.	Stewiacke.	Coxheath, C. B.
Silica	55.20	55.15	50.47	45.611	76.260
Alumina	32.10	22.57	32.69	14.000	19.152
Iron oxide	1,87	6.48	8.01	6.100	trace.
Titannic acid	..	1.75	1.88	....	....
Lime	5.53	1.27	1.85	trace.	.555
Magnesia		1.5[illegible]	2.11	1.096	.170
Alkalies		2.66	1.96	....	.259
Comb'd water	5.30	4.23	1.03	6.550	4.300
Moisture	..	2.88	....	1.000	....
Carbonic acid	..	5.04	....	....	....
Organic matter	..	1.16	....	....	....
Sand	..	....	....	25.689	....

The fire clay from Coxheath Hills, Cape Breton, is an altered felsite, compact, lustre pearly to dull, color pearl grey, greasy to the touch. The analyst, Mr. Hoffman, G. S. R., 1875-76, gives the results of numerous experiments, from which it appeared that the rock alone would not make a brick, as after burning the mass remained friable. When from half to one per cent. of lime was added an excellent refractory brick was produced. Large quantities of this rock, which is well worth a practical test, are reported by Mr. Fletcher to be exposed at Watson's Brook and several localities in the Coxheath and East Bay Hills, at Big Pond, Gillis and Forks Lake Brooks.

During 1879 a few tons of fire clay were burnt into good brick by Mr. Cameron, of Stellarton, and used in the construction of coke ovens by the Halifax Company. The clay is from a bed overlying the McGregor seam, and is four feet thick where opened on the land of the Halifax Company.

Doubtless as the search is extended other clays will be found suitable for refractory bricks, linings, etc., and in this connection the large deposits of infusorial or silicious earth found in many of our lakes, etc., may prove of value.

Refractory Stones.—There has been so little demand for such materials that scarcely any information can be given. Some of the metamorphosed Upper Silurian clay slates of Pictou County afford stones which have been successfully used for lining cupolas, boiler furnaces, etc. I have tested the fire resisting qualities of several sandstones from the Pictou coal field, but did not find them valuable. The upper coal measures may yield sandstones adapted for furnace hearths, etc.

Soapstone has been found, I am informed, in Cape Breton, near Louisburg, and at other points; but I am in possession of no details as to its quality, etc.

At late exhibitions very handsome samples of pottery, vases, jars, ornaments, besides tiles, drain pipes, dishes, etc., have been shown. From these the adaptability of the various white and red clays to the potter's art was satisfactorily shown. Some years ago pottery was made near New Glasgow from a coal measure clay, but work has been discontinued.

Kaolin has been found in small beds at several places on the Atlantic coast, resulting probably from the decomposition of feldspar. As yet, however, it has not received any attention. In Cornwall a large business is carried on in this material, some of which is worked into porcelain, etc., on the spot, and the rest taken to the Midland counties.

Precious Stones.—Our list of precious stones for the purpose of ornament, etc., is a very limited one. A specimen of topaz was shown at the London exhibition of 1872, said to have come from Cape Breton. This may have been a yellow corundum. Garnets are very common in the more highly

metamorphosed slates of the gold districts. They vary in size from a pin's head to crystals one-half an inch in diameter, but, I believe, are generally found to be too brittle for the purpose of the jeweller. Crystals of quartz, commonly known as rock crystals, are very common in the older rocks, and are met in great beauty in some of the gold leads. The mineral, however, is so abundant that they would be valuable only if there were a home demand to admit of their being worked here.

Amethyst, purple quartz, is a very common mineral in the trap districts, where it occurs as crystals and incrustations often of considerable size. Its value depends entirely on its depth and uniformity of color. Specimens from Nova Scotia have been much admired in England and on the continent. The early French settlers sent considerable quantities home, and one very handsome specimen was divided in two and placed in the crown of one of the French kings. Among localities yielding it may be mentioned Parrsboro, Digby Neck, Cape Sharp, Blomidon, Cornwallis, Sandy Cove, etc. Smoky quartz, cairn gorm stone, is very abundant at Paradise, Annapolis County, and many of our auriferous veins present varieties of it. Heliotrope, Jasper, Chalcedony, Agate and Common Opal are also frequently met in the trap districts. The Heliotrope or blood-stone finds a ready sale when in good specimens.

The trap of the Bay of Fundy has acquired an almost world-wide reputation for the variety and beauty of its minerals, which have been formed by the dissolving and concentrating agency of water acting through long ages.

Dr. Gesner, the late Dr. How and others, devoted much time to the determination and collection of these minerals, and very beautiful cabinets have been exhibited at various times.

It would be foreign to the aims of this report to describe, even in the briefest terms, the various minerals and their localities, as they possess scarcely any economic value at present. The following list embraces those best known :—Albin, Analcime, Anatase, Apatite, Apophyllite, Calcspar, Centrallasite, Chabazite, Chlorophœite, Chlorite, Cyanolite, Farœlite, Green Earth, Green Calcspar, Gyrolite, Heulandite, Laumonite, Lederite, Mesolite, Mordenite, Moss Agate, Natrolite, Obsidian, Phrenite, Poonah Earth, Scholesite, Sinter, Stilbite, Tremolite, Thomsonite, and Wichtesite. Those who desire further information on the subject of these trap minerals, the identification, physical characteristics, etc., of their varieties, will find Dana's Mineralogy the best text book.

TENURE OF MINERAL LANDS.

The grants of land to the early settlers in this province contained no regular reservation of minerals ; in some instances gold, silver and precious stones alone were reserved, in other cases, the gold, silver, coal, iron, copper, lead, etc,, were retained for a source of revenue to the Crown. After the year 1868 the reservations were gold, silver, lead, copper, tin, coal, iron, and precious stones. In 1827 all ungranted minerals became the property of the Duke of York and were transferred by him to the General Mining Association. After the agreement with the General Mining Association terminating their monopoly, the government passed an Act in 1858, by which they retained in previous grants, the gold, silver, copper, iron, lead, tin, coal and preciou sstones whenever mentioned, and made the above reservations in all future grants for the purpose of revenue. This Act releases to the owner of the land, all minerals not mentioned above, such as limestones, gypsum, fire clay, barytes, manganese, etc., and any of the above reservations whenever they are not specified in the grant. There is no complete list published of the various grants, but full information as to the position, date and reservation of every grant, can be obtained from the Crown Land Office.

In 1892 the government reserved all minerals excepting gypsum, limestone and building material.

The Department of Public Works and Mines is entrusted with the management of the Crown minerals. Gold areas are obtainable under either prospecting licenses or leases. The unit area is a piece of ground, with vertical boundaries, 150 by 250 feet. Prospecting licenses are granted in blocks containing not less than six, nor more than 100 areas, and not in length exceeding twice the width. These cost at the rate of 50 cents an area, run for 12 months, and can be converted into leased areas. Areas can be applied for directly under lease, or selected from prospecting licenses, at the rate of $2.00 per area. The leases run for 40 years, and when not working pay an annual rental of 50 cents an area. Mill licenses are issued, and the royalty on gold is at the rate of 2 per cent. on unsmelted gold, valued at $18.50 per ounce, Troy, and at $19.00 an ounce on smelted gold.

For minerals other than gold, licenses to search are issued for 18 months, covering an area 2 by $2\frac{1}{2}$ miles. During the term a lease can be selected covering one square mile for coal or iron, one half square mile for lead, copper, etc. These leases cost $50.00, and when work is not performed pay an annual rental of $30.00. The leases are for four renewable terms of 20 years each.

The royalty charged on the coal sold by the Dominion Coal Company is at the rate of 12½ cents per ton of 2,240 lbs., on account of their having a 99 year lease. On the coal sold by the other companies the royalty is ten cents. Coal used for colliery engines and by workmen is not liable to royalty. Proportionate royalties are charged on other minerals.

The Department is constituted a court of record and justice for all mining titles, and is administered under a law framed to facilitate the acquisition and working of mines, with a proper regard to the royalties, which form an important source of revenue.

A mines regulation Act is enforced for the safe working of the properties. Coal mining officials are required to undergo examination, and all colliers are examined as to their experience and ability before taking charge of working faces. Similar regulations govern the employment of engine-drivers at man-hoisting shafts and slopes.

Diamond and Calyx drills are obtainable from the government for exploring work.

COAL—Sales.

Year Ended September 30, 1900.

Names.	1st Quarter.	2nd Quarter.	3rd Quarter.	4th Quarter.	Year 1900.	Year 1899.
Nova Scotia:						
Land Sales .	113,447	98,648	76,653	90,457	379,205	336,807
Sea Borne..	130,141	94,815	114,076	145,663	484,695	392,670
Total N. S.	243,588	193,463	190,729	236,120	863,900	729,477
New Brunswick	92,175	109,137	109,421	95,786	406,519	327,504
Newfoundland .	35,479	25,525	25,073	13,230	99,307	106,755
P. E Island...	25,734	46	20,756	21.567	68,103	66,881
Quebec.....	195,433	32,564	314,399	391,833	934,229	1,029,288
West Indies...	.....	.....	.....	.....	.....	6,044
United States..	151,290	188,618	146,065	138,300	624,273	153,188
Oth'r Countries	.....	.....	.....	1,215	1,215	.....
Total....	743,699	549,353	806,443	898,051	2,997,546	2,419,137

COAL—General Statement.

Year Ended September 30, 1900.

1900.	Production.	Colliery Consumption.	Sales.
1st Quarter.....	736,775	49,807	743,699
2nd "	756,983	58,606	549,353
3rd "	834,945	45,749	806,443
4th "	859,542	54,920	898,051
Total.....	3,238,245	209,082	2,997,546

COAL PRODUCE OF NOVA SCOTIA FOR YEAR ENDED SEPTEMBER 30, 1900.

COLLIERY.	Produce.	Sales.	Colliery Consumption.	
			Engines.	Workmen.
Joggins	67,290	55,456	7,131	1,490
Jubilee	85	58	27	.....
Scotia	525	417	.....	58
Springhill	428,904	403,170	18,448	7,275
Acadia	294,884	258,378	32,290	5,291
Intercolonial	244,000	226,535	14,158	3,326
Dominion Coal Co	1,930,425	1,808,694	65,476	22,565
Nova Scotia Steel Co.	249,910	225,932	16,277	11,756
North Sydney	7,222	7,180	115	342
New Campbellton	12,426	9,891	1,743	792
Port Hood	2,323	1,770	443	79
Broad Cove	56	.....	.....	.....
Mabou	195	65	.....	.....
	3,238,245	2,997,546	156,108	52,974

Nova Scotia Coal Sales, 1785 to 1900 (inclusive.)

Year.	Sales.	Total.	Year.	Sales.	Total.
1785	1,668		1841	148,298	Forw'd 1,208,150
1786	2,000		1842	129,708	
1787			1843	105,161	
1788	10,681		1844	108,482	
1789			1845	150,674	
1790			1846	147,506	
		14,349	1847	201,650	
1791	2,670		1848	187,643	
1792	2,143		1849	174,542	
1793	1,926		1850	180,084	
1794	4,405				1,533,798
1795	5,320		1851	153,499	
1796	5,249		1852	188,076	
1797	6,039		1853	217,416	
1798	5,948		1854	234,812	
1799	8,947		1855	238,215	
1800	8,401		1856	253,492	
		51,048	1857	294,198	
1801	5,755		1858	226,725	
1802	7,769		1859	270,293	
1803	6,601		1860	322,593	
1804	5,976				2,399,319
1805	10,130		1861	326,429	
1806	4,938		1862	395,637	
1807	5,119		1863	429,351	
1808	6,616		1864	576,985	
1809	8,919		1865	635,086	
1810	8,609		1866	558,520	
		70,452	1867	471,185	
1811	8,516		1868	453,624	
1812	9,570		1869	511,795	
1813	9,744		1870	568,277	
1814	9,866				4,927,339
1815	9,336		1871	596,418	
1816	8,619		1872	785,914	
1817	9,284		1873	811,106	
1818	7,920		1874	749,127	
1819	8,692		1875	706,795	
1820	9,980		1876	634,207	
		91,527	1877	697,665	
1821	11,318		1878	693,511	
1822	7,512		1879	688,628	
1823			1880	954,659	
1824	27,000				7,317,430
1825			1881	1,035,014	
2826	12,600		1882	1,250,179	
1827	12,149		1883	1,297,523	
1828	20,967		1884	1,261,650	
1829	21,935		1885	1,254,510	
1830	27,269		1886	1,373,666	
		140,820	1887	1,519,684	
1831	37,170		1888	1,576,692	
1832	50,369		1889	1,755,107	
1833	64,743		1390	1,786,111	
1834	50,813				13,910,136
1835	56,434		1891	1,849,945	
1836	107,593		1892	1,752,934	
1887	118,942		*1893	1,485,904	
1838	106,730		†1894	2,019,742	
1839	145,962		1895	1,831,357	
1840	101,198		1896	2,047,133	
		839,954	1897	2,013,421	
			1898	2,135,397	
			1899	2,419,137	
			1900	2,997,546	20,552,536
				Total	51,848,708

SUMMARY.

1785 to 1790	14,349	1841 to 1850	1,533,798
1791 to 1800	51,048	1851 to 1860	2,399,319
1801 to 1810	70,452	1861 to 1870	4,927,339
1811 to 1820	91,527	1871 to 1880	7,317,430
1821 to 1830	140,820	1881 to 1890	13,910,136
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*Nine months only. Fiscal year begins Oct. 1 and ends Sep. 30. (Cap. 4, Acts 1893.)

COAL

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1851	116,274	"	1877	118,216	"
1852	87,542	"	1878	88,495	"
1853	120,764	"	1879	51,641	"
1854	139,125	Free.	1880	123,423	"
1855	103,222	"	1881	113,728	"
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1857	123,335	"	1883	102,755	"
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1859	122,720	"	1885	34,484	"
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1861	204,457	"	1887	73,892	"
1862	192,612	"	1888	30,198	"
1863	282,775	"	1889	29,986	"
1864	347,594	"	1890	50,854	"
1865	465,194	"	1891	25,431	"
1866	404,252	"	1892	13,883	"
1867	338,492	$1.25	1893	16,099	"
1868	228,132	"	*1894	79,837	40
1869	257,485	"	†1895	73,097	"
1870	168,180	"	‡1896	174,919	"
1871	165,431	"	1897	106,279	"
1872	154,092	75	1898	98,027	"
1873	254,760	"	1899	153,188	"
1874	138,336	"	1900	624,273	"
1875	89,746	"	....	.....	....

NOTE.—The quantities given for the years 1852 to 1872 are on the authority of the Board of Trade, Philadelphia, and are probably under-estimated.

*Nine months only.

†NOTE.—After August 1st, 1894, duty on Round Coal 40 cents, on Culm or Slack, 15 cents.

‡Fiscal year begins October 1st, and ends September 30th.

GENERAL GOLD STATEMENNT.

Year ended Sept. 30th, 1900.

DISTRICT.	Days' Labor.	Tons Crushed.	Average yield of Gold per ton.			Total yield of Gold.		
			Oz.	Dwts.	Grs.	Oz.	Dwts.	Grs.
Oldham	.....	1519	.....	18	2	1379	16	8
Sherbrooke	34632	17711	.....	5	9	4763	12	9
Wine Harbor	13975	3691	.....	11	7	2088	17	0
Lake Catcha	6414	756	.....	13	10	507	3	6
Montague	436	636	.....	15	3	481	3	7
Harrigan Cove	.....	1813	.....	18	19	1705	9	12
Brookfield	13333	9291	.....	5	20	2726	16	13
Renfrew	.....	459	9	13	22	4450	15	22
Caribou & Moose River	8348	8348	.....	3	21	1633	6	23
Stormont	33467	28238	.....	5	11	7745	18	10
Salmon River	17959	8825	.....	2	7	1027	14	..
Other Districts	19913	4457	.....	8	11	1888	11	.
	.....	65744	.....	.....	.....	30399	14	14

Wallace Rivers, and at Greenville, Cumberland County. It is frequently found with the manganese ores of Hants and Colchester counties. In Cape Breton it was mined for several years at Lake Ainslie, and at present an annual output of 783 tons is secured from Cape Rouge, Inverness County. Other localities reported in Cape Breton are Whyhogomah, Cheticamp, Loch Lomond, St. Annes and East Bay.

Fire Clays.—Clays are essentially hydrated silicates oi alumina, also holding moisture. Their plasticity when mixed with water depends on the presence of the water of composition, and when heated to redress, it is driven off, and they lose this property. When these clays stand a high temperature without melting or softening, they are termed refractory or fire-clays. They occur in various geological formations, those of the best quality being generally obtained from the coal measures, where they usually form the beds underlying the coal seams.

The mechanical mixtures accompanying clays are silica, carbonates of lime and magnesia, pyrites, etc. They affect the heated clay in various ways, by causing unequal expansion and cracking, and by forming fusible slags. These effects depend not only on the amounts of the impurities, but also on their relative proportions, as in the case of furnace slags. Among the purer clays are those holding large proportions of pure silicious sand, such as the celebrated Dinas brick clay.

Fire bricks are required to stand in some cases, high and prolonged heat, alternations of temperature, not to soften when heated, or run when in the presence of heated metallic oxides. Any one clay will seldom meet all of the above requirements, and various materials are added to counteract the failing, such as sand, powdered millstone grit, clay previously burned and ground, etc.

The method of making fire brick resembles that followed in the manufacture of common brick. The clay, after weathering, is carefully ground, etc., and burned for five or six days in kilns of 15 to 20 thousand.

The following analyses will show the composition of several Nova Scotia fire clays :—

	Lingan.	Deep Seam.	Springhill.	Stewiacke.	Coxheath, C. B.
Silica	55.20	55.15	50.47	45.611	76.260
Alumina	32.10	22.57	32.69	14.000	19.152
Iron oxide	1,87	6.48	8.01	6.100	trace.
Titannic acid	..	1.75	1.88	....	....
Lime	5.53	1.27	1.85	trace.	.555
Magnesia		1.58	2.11	1.096	.170
Alkalies		2.66	1.96	....	.259
Comb'd water	5.30	4.23	1.03	6.550	4.300
Moisture	..	2.88	....	1.000	....
Carbonic acid	..	5.04	....	....	....
Organic matter	..	1.16	....	....	....
Sand	..	....	....	25.689	....

The fire clay from Coxheath Hills, Cape Breton, is an altered felsite, compact, lustre pearly to dull, color pearl grey, greasy to the touch. The analyst, Mr. Hoffman, G. S. R., 1875-76, gives the results of numerous experiments, from which it appeared that the rock alone would not make a brick, as after burning the mass remained friable. When from half to one per cent. of lime was added an excellent refractory brick was produced. Large quantities of this rock, which is well worth a practical test, are reported by Mr. Fletcher to be exposed at Watson's Brook and several localities in the Coxheath and East Bay Hills, at Big Pond, Gillis and Forks Lake Brooks.

During 1879 a few tons of fire clay were burnt into good brick by Mr. Cameron, of Stellarton, and used in the construction of coke ovens by the Halifax Company. The clay is from a bed overlying the McGregor seam, and is four feet thick where opened on the land of the Halifax Company.

Doubtless as the search is extended other clays will be found suitable for refractory bricks, linings, etc., and in this connection the large deposits of infusorial or silicious earth found in many of our lakes, etc., may prove of value.

Refractory Stones.—There has been so little demand for such materials that scarcely any information can be given. Some of the metamorphosed Upper Silurian clay slates of Pictou County afford stones which have been successfully used for lining cupolas, boiler furnaces, etc. I have tested the fire resisting qualities of several sandstones from the Pictou coal field, but did not find them valuable. The upper coal measures may yield sandstones adapted for furnace hearths, etc.

Soapstone has been found, I am informed, in Cape Breton, near Louisburg, and at other points; but I am in possession of no details as to its quality, etc.

At late exhibitions very handsome samples of pottery, vases, jars, ornaments, besides tiles, drain pipes, dishes, etc., have been shown. From these the adaptability of the various white and red clays to the potter's art was satisfactorily shown. Some years ago pottery was made near New Glasgow from a coal measure clay, but work has been discontinued.

Kaolin has been found in small beds at several places on the Atlantic coast, resulting probably from the decomposition of feldspar. As yet, however, it has not received any attention. In Cornwall a large business is carried on in this material, some of which is worked into porcelain, etc., on the spot, and the rest taken to the Midland counties.

Precious Stones.—Our list of precious stones for the purpose of ornament, etc., is a very limited one. A specimen of topaz was shown at the London exhibition of 1872, said to have come from Cape Breton. This may have been a yellow corundum. Garnets are very common in the more highly

metamorphosed slates of the gold districts. They vary in size from a pin's head to crystals one-half an inch in diameter, but, I believe, are generally found to be too brittle for the purpose of the jeweller. Crystals of quartz, commonly known as rock crystals, are very common in the older rocks, and are met in great beauty in some of the gold leads. The mineral, however, is so abundant that they would be valuable only if there were a home demand to admit of their being worked here.

Amethyst, purple quartz, is a very common mineral in the trap districts, where it occurs as crystals and incrustations often of considerable size. Its value depends entirely on its depth and uniformity of color. Specimens from Nova Scotia have been much admired in England and on the continent. The early French settlers sent considerable quantities home, and one very handsome specimen was divided in two and placed in the crown of one of the French kings. Among localities yielding it may be mentioned Parrsboro, Digby Neck, Cape Sharp, Blomidon, Cornwallis, Sandy Cove, etc. Smoky quartz, cairn gorm stone, is very abundant at Paradise, Annapolis County, and many of our auriferous veins present varieties of it. Heliotrope, Jasper, Chalcedony, Agate and Common Opal are also frequently met in the trap districts. The Heliotrope or blood-stone finds a ready sale when in good specimens.

The trap of the Bay of Fundy has acquired an almost world-wide reputation for the variety and beauty of its minerals, which have been formed by the dissolving and concentrating agency of water acting through long ages.

Dr. Gesner, the late Dr. How and others, devoted much time to the determination and collection of these minerals, and very beautiful cabinets have been exhibited at various times.

It would be foreign to the aims of this report to describe, even in the briefest terms, the various minerals and their localities, as they possess scarcely any economic value at present. The following list embraces those best known :—Albin, Analcime, Anatase, Apatite, Apophyllite, Calcspar, Centrallasite, Chabazite, Chlorophœite, Chlorite, Cyanolite, Farœlite, Green Earth, Green Calcspar, Gyrolite, Heulandite, Laumonite, Lederite, Mesolite, Mordenite, Moss Agate, Natrolite, Obsidian, Phrenite, Poonah Earth, Scholesite, Sinter, Stilbite, Tremolite, Thomsonite, and Wichtesite. Those who desire further information on the subject of these trap minerals, the identification, physical characteristics, etc., of their varieties, will find Dana's Mineralogy the best text book.

TENURE OF MINERAL LANDS

The grants of land to the early settlers in this province contained no regular reservation of minerals; in some instances gold, silver and precious stones alone were reserved, in other cases, the gold, silver, coal, iron, copper, lead, etc,, were retained for a source of revenue to the Crown. After the year 1868 the reservations were gold, silver, lead, copper, tin, coal, iron, and precious stones. In 1827 all ungranted minerals became the property of the Duke of York and were transferred by him to the General Mining Association. After the agreement with the General Mining Association terminating their monopoly, the government passed an Act in 1858, by which they retained in previous grants, the gold, silver, copper, iron, lead, tin, coal and preciou sstones whenever mentioned, and made the above reservations in all future grants for the purpose of revenue. This Act releases to the owner of the land, all minerals not mentioned above, such as limestones, gypsum, fire clay, barytes, manganese, etc., and any of the above reservations whenever they are not specified in the grant. There is no complete list published of the various grants, but full information as to the position, date and reservation of every grant, can be obtained from the Crown Land Office.

In 1892 the government reserved all minerals excepting gypsum, limestone and building material.

The Department of Public Works and Mines is entrusted with the management of the Crown minerals. Gold areas are obtainable under either prospecting licenses or leases. The unit area is a piece of ground, with vertical boundaries, 150 by 250 feet. Prospecting licenses are granted in blocks containing not less than six, nor more than 100 areas, and not in length exceeding twice the width. These cost at the rate of 50 cents an area, run for 12 months, and can be converted into leased areas. Areas can be applied for directly under lease, or selected from prospecting licenses, at the rate of $2.00 per area. The leases run for 40 years, and when not working pay an annual rental of 50 cents an area. Mill licenses are issued, and the royalty on gold is at the rate of 2 per cent. on unsmelted gold, valued at $18.50 per ounce, Troy, and at $19.00 an ounce on smelted gold.

For minerals other than gold, licenses to search are issued for 18 months, covering an area 2 by $2\frac{1}{2}$ miles. During the term a lease can be selected covering one square mile for coal or iron, one half square mile for lead, copper, etc. These leases cost $50.00, and when work is not performed pay an annual rental of $30.00. The leases are for four renewable terms of 20 years each.

The royalty charged on the coal sold by the Dominion Coal Company is at the rate of 12½ cents per ton of 2,240 lbs., on account of their having a 99 year lease. On the coal sold by the other companies the royalty is ten cents. Coal used for colliery engines and by workmen is not liable to royalty. Proportionate royalties are charged on other minerals.

The Department is constituted a court of record and justice for all mining titles, and is administered under a law framed to facilitate the acquisition and working of mines, with a proper regard to the royalties, which form an important source of revenue.

A mines regulation Act is enforced for the safe working of the properties. Coal mining officials are required to undergo examination, and all colliers are examined as to their experience and ability before taking charge of working faces. Similar regulations govern the employment of engine-drivers at man-hoisting shafts and slopes.

Diamond and Calyx drills are obtainable from the government for exploring work.

COAL—Sales.

Year Ended September 30, 1900.

Names.	1st Quarter.	2nd Quarter.	3rd Quarter.	4th Quarter.	Year 1900.	Year 1899.
Nova Scotia:						
Land Sales .	113,447	98,648	76,653	90,457	379,205	336,807
Sea Borne..	130,141	94,815	114,076	145,663	484,695	392,670
Total N. S.	243,588	193,463	190,729	236,120	863,900	729,477
New Brunswick	92,175	109,137	109,421	95,786	406,519	327,504
Newfoundland .	35,479	25,525	25,073	13,230	99,307	106,755
P. E Island...	25,734	46	20,756	21.567	68,103	66,881
Quebec.....	195,433	32,564	314,399	391,833	934,229	1,029,288
West Indies...	.....	.....	.....	.....	.....	6,044
United States..	151,290	188,618	146,065	138,300	624,273	153,188
Oth'r Countries	.....	.....	.....	1,215	1,215	.....
Total....	743,699	549,353	806,443	898,051	2,997,546	2,419,137

COAL—General Statement.

Year Ended September 30, 1900.

1900.	Production.	Colliery Consumption.	Sales.
1st Quarter.....	736,775	49,807	743,699
2nd "	756,983	58,606	549,353
3rd "	834,945	45,749	806,443
4th "	859,542	54,920	898,051
Total.....	3,238,245	209,082	2,997,546

COAL PRODUCE OF NOVA SCOTIA FOR YEAR ENDED SEPTEMBER 30, 1900.

COLLIERY.	Produce.	Sales.	Colliery Consumption.	
			Engines.	Workmen.
Joggins	67,290	55,456	7,131	1,490
Jubilee	85	58	27	.....
Scotia	525	417	.....	58
Springhill	428,904	403,170	18,448	7,275
Acadia	294,884	258,378	32,290	5,291
Intercolonial	244,000	226,535	14,158	3,326
Dominion Coal Co	1,930,425	1,808,694	65,476	22,565
Nova Scotia Steel Co.	249,910	225,932	16,277	11,756
North Sydney	7,222	7,180	115	342
New Campbellton	12,426	9,891	1,743	792
Port Hood	2,323	1,770	443	79
Broad Cove.	56	.....	.....	.....
Mabou.	195	65	.....	.....
	3,238,245	2,997,546	156,108	52,974

Nova Scotia Coal Sales, 1785 to 1900 (inclusive.)

Year.	Sales.	Total.	Year.	Sales.	Total.
1785	1,668		1841	148,298	Forw'd 1,208,150
1786	2,000		1842	129,708	
1787			1843	105,161	
1788	10,681		1844	108,482	
1789			1845	150,674	
1790			1846	147,506	
		14,349	1847	201,650	
1791	2,670		1848	187,643	
1792	2,143		1849	174,542	
1793	1,926		1850	180,084	
1794	4,405				1,533,798
1795	5,320		1851	153,499	
1796	5,249		1852	188,076	
1797	6,039		1853	217,416	
1798	5,948		1854	234,812	
1799	8,947		1855	238,215	
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1871	165,431	"	1897	106,279	"
1872	154,092	75	1898	98,027	"
1873	254,760	"	1899	153,188	"
1874	138,336	"	1900	624,273	"
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			Oz.	Dwts.	Grs.	Oz.	Dwts.	Grs.
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Wine Harbor	13975	3691	.....	11	7	2088	17	0
Lake Catcha	6414	756	.....	13	10	507	3	6
Montague	436	636	.....	15	3	481	3	7
Harrigan Cove	.....	1813	.....	18	19	1705	9	12
Brookfield	13333	9291	.....	5	20	2726	16	13
Renfrew	.....	459	9	13	22	4450	15	22
Caribou & Moose River	8348	8348	.....	3	21	1633	6	23
Stormont	33467	28238	.....	5	11	7745	18	10
Salmon River	17959	8825	.....	2	7	1027	14	..
Other Districts	19913	4457	.....	8	11	1888	11	.
	.....	65744	.....	.....	.....	30399	14	14